FINAL
WRANGELL INSTITUTE SITE ASSESSMENT
WRANGELL, ALASKA

Prepared For

Alaska Department of Environmental Conservation
Spill Prevention and Response
Contracts and Grants Unit
555 Cordova Street
Anchorage, AK 99501

February, 2004

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ACRONYMS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ADOT&PF	Alaska Department of Transportation and Public Facilities
AST	aboveground storage tank
bgs	below ground surface
BIA	Bureau of Indian Affairs
biocell	biological treatment cell
BLM	Bureau of Land Management
BTEX	benzene, toluene, ethylbenzene, and xylenes
CDI	Carson Dorn, Inc.
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CIRI	Cook Inlet Regional Corporation, Inc.
DRO	diesel range organics
ERL	Effects Range-Low
ERM	Effects Range-Median
GPS	global positioning system
HAVE	hot air vapor extraction system
Institute	Wrangell Institute
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NOAA	National Oceanic and Atmospheric Administration
PAH	polynuclear aromatic hydrocarbon
PID	photoionization detector
ppm	parts per million
PVC	polyvinyl chloride
RA/TELLUS	RA Environmental/Tellus, LTD
SIM	selective ion monitoring
SLR	SLR Alaska
TAH	total aromatic hydrocarbons
TAqH	total aqueous hydrocarbons
TOC	total organic content
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
UST	underground storage tank
VOC	volatile organic compound

1 EXECUTIVE SUMMARY

The Alaska Department of Environmental Conservation (ADEC) contracted SLR Alaska (SLR) to conduct soil, surface water, and groundwater sampling at the Wrangell Institute (Institute) in Wrangell, Alaska. This report summarizes the historical land use and site assessments, the recent site assessment, and recommendations for future remedial and disposal actions.

The subsurface soil investigation focused on areas with hydrocarbon-impacted soil known to exceed ADEC cleanup levels as specified in Title 18, Chapter 75, Section 341 of the Alaska Administrative Code (18 AAC 75.341). These areas include former locations of underground storage tanks (UST) and the interconnecting underground pipeline system. Hydrocarbon-impacted subsurface soil was observed in five principal areas within, or immediately outside, the Institute property. These plumes encompass an estimated 5,880 cubic yards of soil exceeding the ADEC Method 2 cleanup level for diesel range organics (DRO). The range of DRO concentrations in soil samples from the identified soil plumes are 230 milligrams per kilogram (mg/kg) to 150,000 mg/kg. Portions of the impacted soil plumes are within land tentatively designated wetlands, although this status is subject to U.S. Army Corps of Engineers review (Walsh Planning and Development Services, 2003).

Groundwater was sampled in ten newly constructed monitoring wells and two existing water supply wells. DRO concentrations in samples from two on-property monitoring wells exceeded 18 AAC 75.345, Table C cleanup levels. In addition, groundwater sample results from five on-property monitoring wells exceeded ADEC polynuclear aromatic hydrocarbon (PAH) cleanup levels.

Surface water and sediment samples were collected at ten locations around the Institute perimeter. Two surface water sample results exceeded ADEC cleanup levels for benzo(a)pyrene. Four sediment sample results exceeded the ADEC Method 2 DRO cleanup level. All the sediment samples with concentrations exceeding the DRO cleanup levels were collected adjacent to or downgradient of the 3-inch supply pipeline. The sample with the highest DRO concentration, SED-4, also exceeded the ERM for 2-Methylnaphthalene.

In addition to the estimated 5,880 cubic yards of in-place soil exceeding the DRO cleanup level, there is a total of approximately 2,050 cubic yards of soil stored in two stockpiles that require treatment and/or disposal. A total of 21 soil samples have been taken from these stockpiles and analyzed for DRO. The DRO concentrations found in stockpile soil samples range from 310 mg/kg to 5,300 mg/kg. A total of eight soil samples from the stockpiles were analyzed for BTEX. One sample, from the Carson Dorn, Inc. (CDI) stockpile, exceeded the ADEC Method 2 cleanup level for benzene (CDI, 2003; RA Environmental/Tellus, LTD [RA/TELLUS] 1999).

Analysis indicates that the remediation options that would best be applied to this site are off-site disposal or treatment, followed by thermal treatment, roadbed encapsulation, biological treatment in a biocell, and finally, biological treatment by landfarming.

2 INTRODUCTION

The Institute is located on Wrangell Island in southeast Alaska (Figure 1). The Institute is located approximately five miles south of downtown Wrangell, via Zimovia Highway, adjacent to Shoemaker Bay (Figure 2).

2.1 Purpose

The ADEC contracted SLR to conduct soil, surface water, and groundwater sampling at the Institute in Wrangell, Alaska. This report summarizes historical land use and site assessments, recent site assessment, and recommendations for future remedial and disposal actions.

2.2 Objectives

The objectives of the site assessment were to:

- Determine the volume and concentrations of contaminated soil that remains on-site and evaluate whether ADEC Method 3 alternative soil cleanup levels are appropriate based upon the migration to groundwater pathway.
- Determine if groundwater contamination exists at levels exceeding the 18 AAC 75.345, Table C values and if the contaminated groundwater is migrating to marine sediment and surface water.
- Determine if contamination exists in the sediment and surface water of nearby streams or springs.
- Evaluate and estimate the costs for several treatment disposal options for up to 2,050 cubic yards of diesel-contaminated soil stockpiled on City-owned land (Figures 1 and 2).

3 BACKGROUND

An overview of historical land use, site activities, regional and local geology, and regulatory criteria are summarized in this section.

3.1 Land Use Overview

In 1932, the Bureau of Indian Affairs (BIA) constructed the Institute on a 12-acre parcel to serve as a boarding school for Native Alaskan children from around the state until 1975. The BIA managed the facility until it was transferred to the Bureau of Land Management (BLM) in April 1978. Seven months later BLM conveyed the property to Cook Inlet Regional Corporation, Inc. (CIRI). During the same period, approximately 1977-1980, the U.S. Forest Service (USFS) operated and maintained the buildings in conjunction with the Young Adult Conservation Corps. In 1995, ownership of the property was transferred to the City of Wrangell (CDI, 2003).

During the Institute's operations, a 2-inch pipeline distributed heating oil from a pair of 20,000-gallon aboveground storage tanks (ASTs) to nine tanks (seven USTs and two ASTs) adjacent to the buildings. The 20,000-gallon ASTs, located at the upper southeast corner of the property, were supplied by a 3-inch pipeline that extended approximately 500 feet along the southern boundary of the property. All heating oil used at the property was likely No. 2 diesel. Although bunker fuel was commonly used as heating fuel in federal facilities during the 1940s, no evidence exists that it was used at this site. In addition, a UST located on the north end of the property stored gasoline and was used for vehicle fueling (CDI, 2003).

Figure 3 shows the former Institute property including locations of structures as they existed prior to their demolition in 2001. Additionally, the figure shows the former locations of tanks and the associated piping.

3.2 Historical Site Assessment and Activities

In 1999, all 12 fuel storage tanks were removed from the Institute property by RA/TELLUS under contract with the City of Wrangell (RA/TELLUS, 1999). A detailed summary of the locations, dimensions, and investigation results of fuel storage tanks is presented in Table 1. The tanks included 11 heating oil tanks and 1 gasoline tank as follows (see Figure 3):

- Two heating oil ASTs with capacities of 400 gallons (Tank 1) and 275 gallons (Tank 4) connected by pipeline to the primary ASTs

- One stand-alone gasoline UST which had a capacity of 1,200 gallons and was used for vehicle fueling (Tank 2)

- Seven heating oil USTs, of which six had a capacity of 600 gallons (Tanks 3, 5, 6, 7, 9, and 10) and one had a capacity of 1,200 gallons (Tank 8) connected by pipeline to the primary ASTs

- Two primary heating oil ASTs, each with a 20,000-gallon capacity (Tanks 11 and 12)

In addition to the tank removal work, RA/TELLUS performed limited site characterization, soil sampling, and contaminated soil removal activities. The results presented in a report (RA/TELLUS, 1999) documented no contamination at three (Tanks 2, 11, and 12) of the twelve sites, including the underground gasoline tank. However, contamination was found at the other nine underground heating oil tank sites. Cleanup at three of the nine contaminated sites, the 400-gallon AST at Building 218 (Tank 1), the 600-gallon UST at Building 204 (Tank 3), and the 275-gallon AST at Building 221 (Tank 4), successfully achieved soil cleanup levels. When the RA/TELLUS work was completed, a total of six sites (Tanks 5 – 10) were documented to have contamination remaining above ADEC cleanup criteria. Approximately 750 cubic yards that had been excavated were stockpiled at a municipal-owned rock quarry (RA/TELLUS, 1999).

In 2001, CDI performed site assessment, stockpile sampling, building demolition, and soil removal at the site. All structures and foundations were removed. Although some of the pipeline was removed, much of the pipeline remains on site. The most significant portion of remaining pipeline is the 3-inch supply pipeline extending approximately 500 feet along the southern boundary of the property. In addition, portions of the site were leveled and partially graded. Approximately 1,300 cubic yards of diesel-contaminated soil was removed from five areas on the site and stored in a stockpile at a site near the Institute (Figure 2). CDI concluded that diesel contaminated soil remained widespread across the property. CDI estimated that a minimum of 7,100 cubic yards of diesel-contaminated soil remained in place, and DRO was detected in soil samples at concentrations ranging from 550 mg/kg to 25,000 mg/kg (CDI, 2003).

3.3 Regional and Local Geology

The bedrock in the vicinity of the Institute consists of Cretaceous sedimentary and intrusive rocks. The sedimentary rocks include marine greywacke and mudstone, subordinate conglomerate, andesitic to basaltic volcanic rocks, minor limestone, and regionally metamorphosed versions of these strata. The intrusive rocks include granodiorite and tonalite of Paleocene or Cretaceous age (Gehrels and Berg, 1992).

The principal surficial materials in the area are generally alluvial deposits consisting of stratified silt, sand, and gravel (Hogan, 1995). The soils that develop on the well-drained surficial materials are characterized by an organic-rich layer approximately 0.5 foot thick. Groundwater is reported to be between 3 and 11 feet below ground surface (bgs), and is shallower on the southern side of the property (CDI, 2003).

3.4 Regional and Local Climate

Wrangell has a maritime climate characterized by cool, wet summers and relatively mild winters. The mean annual precipitation at the Wrangell Airport is 81.5 inches and the mean annual snowfall is 62.4 inches (Leslie, 1989).

3.5 Regulatory Criteria

The applicable surface water, groundwater, and soil regulatory criteria are discussed as follows.

3.5.1 Soil Cleanup Levels

The regulatory criteria applicable to soils at the site are the ADEC Method 2 cleanup levels for the over 40-inch zone, as specified in 18 AAC 75.341, Table B1. These cleanup level concentrations for petroleum hydrocarbon constituents found in soil at the Institute consist of the following:

•DRO	230 mg/kg	Migration to groundwater
•Benzene	0.02 mg/kg	Migration to groundwater
•Toluene	4.8 mg/kg	Migration to groundwater
•Ethylbenzene	5 mg/kg	Migration to groundwater
•Xylenes	69 mg/kg	Migration to groundwater
•Acenaphthene	190 mg/kg	Migration to groundwater
•Anthracene	3,900 mg/kg	Migration to groundwater
•Benzo(a)anthracene	5.5 mg/kg	Migration to groundwater
•Benzo(a)pyrene	0.9 mg/kg	Ingestion
•Chrysene	550 mg/kg	Migration to groundwater
•Fluoranthene	1,900 mg/kg	Migration to groundwater
•Fluorene	240 mg/kg	Migration to groundwater
•Naphthalene	19 mg/kg	Migration to groundwater
•Pyrene	1,400 mg/kg	Migration to groundwater

In addition to the tabulated Method 2 cleanup levels, soil cleanup levels are required to be protective of surface water quality standards and cleanup levels.

3.5.2 Surface and Groundwater Criteria

ADEC water quality criteria, as specified by 18 AAC 70, prescribes water quality standards applicable to this site. Fresh water (nonmarine surface water) is protected under three classifications: 1) water supply; 2) water recreation and growth; and 3) propagation of fish, shellfish, and other aquatic life and wildlife. The fresh water use with the most restrictive water quality criteria for petroleum hydrocarbons, oils, and grease is propagation of fish, shellfish, and other aquatic life and wildlife. The threshold concentrations of petroleum hydrocarbons for this use class include the following:

•Total aqueous hydrocarbons (TaqH)	0.015 milligrams per liter (mg/L)
•Total aromatic hydrocarbons (TAH)	0.010 mg/L
•Benzene	0.005 mg/L

ADEC groundwater and surface water cleanup levels, as specified in 18 AAC 75.345, Table C, are applicable to this site. The groundwater cleanup levels for applicable compounds found present in soil at the Wrangell Institute are as follows:

•DRO	1.5 mg/L
•Benzene	0.005 mg/L
•Toluene	1.0 mg/L
•Ethylbenzene	0.7 mg/L
•Xylenes	10.0 mg/L
•Acenaphthene	2.2 mg/L
•Acenaphthylene	2.2 mg/L
•Anthracene	11.0 mg/L
•Benzo(b)fluorine	0.001 mg/L
•Benzo(k)fluorine	0.01 mg/L
•Fluorene	1.46 mg/L
•Indeno(1,2,3-cd)pyrene	0.001 mg/L
•Naphthalene	0.7 mg/L
•Pyrene	1.1 mg/L

In accordance with ADEC Division of Spill Prevention and Response regulations (ADEC, 2001), alternate cleanup levels must be protective of water quality standards.

3.5.3 Sediment Guidelines

The National Oceanic and Atmospheric Administration (NOAA) developed numerical sediment guidelines as informal, interpretative tools for the National Status and Trends Program. Although the guidelines are not intended as cleanup or remediation targets, they are used in interpreting chemical data from analysis of sediments (NOAA, 1999).

Data from freshwater and saltwater sediment analyses were arranged in order of ascending concentrations. Study endpoints in which adverse effects were reported were identified. From the ascending tables, the 10^{th} percentile was identified as the "Effects Range-Low" (ERL) and the 50^{th} percentile was identified as the "Effects Range-Median" (ERM) for each analyte. The ERL is indicative of concentrations below which adverse effects rarely occur. The ERM is indicative of concentrations below which adverse effects frequently occur (NOAA, 1999).

The ERL and ERM for hydrocarbon compounds detected at the Institute are presented below (dry weight basis).

•2-Methylnaphthalene	0.070 mg/kg	0.670 mg/kg
• Benzo(a)anthracene	0.261 mg/kg	1.6 mg/kg
•Chrysene	0.384 mg/kg	2.8 mg/kg
•Fluoranthene	0.6 mg/kg	5.1 mg/kg
•Fluorene	0.019 mg/kg	0.540 mg/kg
•Naphthalene	0.160 mg/kg	2,1 mg/kg
•Pyrene	0.665 mg/kg	2.6 mg/kg

4 ENVIRONMENTAL SITE ASSESSMENT ACTIVITIES

SLR Alaska staff performed field investigation to determine the following site conditions:

- soil subsurface conditions
- groundwater quality
- surface water quality
- surface sediment quality

4.1 Analytical Methods

Based on field screening results, soil samples were submitted for laboratory analysis. The samples were analyzed for one or more of the following:

- Benzene, toluene, ethylbenzene, and xylenes (BTEX) using U.S. Environmental Protection Agency (USEPA) Method 8021B
- DRO using Alaska Method 102
- ADEC-priority PAH compounds using USEPA Method 8270 with selective ion monitoring (SIM)
- Total organic carbon (TOC) using USEPA Method 9060
- PetroFlag® turbidimetric screening method using USEPA Method 9074

SLR collected soil samples to be analyzed for PAH compounds from as many unique source locations as possible (for example, the 3-inch pipeline, 2-inch pipeline, and several UST locations). In addition, soil samples analyzed for TOC content were collected from uncontaminated soil representative of sediments in the area.

Groundwater samples were sent for laboratory analysis for one or more of the following compounds:

- BTEX using USEPA Method 8021B
- DRO using Alaska Method 102
- PAH using USEPA Method 610

Surface water samples were sent for laboratory analysis for the following compounds:

- TAH using USEPA Method 602
- TAqH using USEPA Method 602 and 610

Surface sediment samples collected at the same location as surface water samples were sent for laboratory analysis of the following compounds:

- BTEX using USEPA Method 8021B
- DRO using Alaska Method 102
- ADEC-priority PAH components using USEPA Method 8270 SIM

Field duplicate samples were collected at a frequency of 10 percent of the total number of samples collected. Trip blanks for each of the groundwater sampling parameters accompanied the shipment of containers to and from the site and were analyzed with the groundwater samples. Laboratory analytical reports and quality assurance reviews prepared by an SLR chemist are presented in Appendix A.

Twelve samples were analyzed by both Alaska Method 102 and the PetroFlag® turbidimetric screening method using USEPA Method 9074 (Table 2). The screening method results were observed to be higher than the laboratory methods in all but one of the samples.

4.2 Field Investigation Methods

The investigation methodology implemented for subsurface soil, groundwater, surface water, and sediment sampling are presented below. The former locations of the building footprints and other baseline data provided by CDI were uploaded to a Trimble model Pathfinder Pro XR® global positioning system (GPS) receiver. In addition, all new sample locations and new baseline data were recorded with the GPS receiver.

Photographs taken during the site investigation are presented in Appendix B.

4.2.1 Subsurface Soil Investigation

Test pits were excavated with a Hitachi® EX160LC backhoe. The test pits were advanced to groundwater. Test pit soil lithology, distribution of visible soil contamination in the test pits, locations and times of all samples collected, and other pertinent information, were recorded by SLR personnel. Soil texture descriptions were completed in accordance with the Unified Soil Classification System (USCS). Soil lithology from all test pits is presented in Appendix C. Upon completion of sampling, the test pits were backfilled with the excavated soil.

The soil was field screened using two methods. Headspace samples were collected and screened for volatile organic compounds (VOCs) using a photoionization detector (PID). Prior to use, the PID was calibrated with 100 parts per million (ppm) isobutylene gas. Representative soil samples

were sealed in a Ziploc® bag, heated for approximately 10 minutes, and sampled by inserting the tip of the PID into the Ziploc® bag. The PetroFlag® turbidimetric screening method (USEPA Method 9074) was also used to provide immediate soil quality data. Observational and field screening data was used to determine the locations of analytical samples.

Test pit subsurface soil sample nomenclature was assigned as follows: Each test pit location was named with a 'TP' followed by a site letter designation; each sample depth was designated by a hyphenated suffix. For example, sample 'TP-HH-2' was collected at site TP-HH from a depth of 2 feet bgs.

The 3-inch supply pipeline area was investigated by sampling soil at the connector joints between the pipeline segments. Due to the restricted access, the soil was excavated by hand auger. Each pipe joint sample location was labeled with the prefix 'PJ' and was assigned a number. For example, sample 'PJ-6-0.5' was collected at pipe joint #6 at a depth of 0.5 feet.

4.2.2 Groundwater Investigation

SLR installed eight groundwater monitoring wells on the Institute property and two downgradient of the property. Monitoring wells were constructed using preconstructed well screens set into backhoe pits. The prepacked wells consisted of a 2-inch-diameter, schedule 40 polyvinyl chloride (PVC) screen with 0.010-inch factory cut slots and casing placed inside a 4-inch diameter PVC screen with 0.010-inch factory cut slots and casing. The 2-inch and 4-inch screens were capped on the bottom. A filter pack consisting of #16-30 silica sand was placed in the space between the 2- and 4-inch screens to a height of approximately 0.5 foot above the top of the screened interval. The wells were then placed in the excavation and native material was backfilled around the well to a depth of 0.5 foot above the top of the screened interval. A 0.5-foot-thick bentonite pellet seal was placed above the filter pack and hydrated. The remaining exterior annular space in the excavation was backfilled with #16-30 silica sand. All field notes and well completion information is presented in Appendix D.

The ten newly constructed monitoring wells were developed and sampled in accordance with ADEC (00000, 2002) guidance. Two existing water supply wells located on the Institute property were also sampled. Prior to sampling, SLR geologists measured the depth to water, checked for the presence of free-phase hydrocarbons, and purged at least three casing volumes from each well using a new disposable polyethylene bailer. Field measurements of temperature, pH, and specific conductivity were recorded on SLR Well Sampling Calculation and Record Sheets during the removal of the purge water. The field measurements for samples are included as Appendix E.

4.2.3 Surface Water and Sediment Investigation

A surface water spring/seep survey was conducted in the areas downslope from petroleum-impacted soils. Surface water samples were collected from springs/seeps and corrugated metal pipe outlets located at the margins of the Institute property.

Sediment samples were collected at all surface water sample locations. The sediments were scooped with individual stainless steel spoons, homogenized in stainless steel bowls, and placed in the appropriate laboratory containers.

4.3 Site Characterization

All surveying, sample collection, test pit excavations, and monitoring well installations were conducted from October 29 to November 11, 2003. Observational, screening, and analytical data for subsurface soil, groundwater, surface water, and sediments are presented below.

4.3.1 Subsurface Soil Conditions

The subsurface soil investigation focused on areas with hydrocarbon-impacted soil known to exceed ADEC Method 2 cleanup levels. These areas included former UST, AST, and test pit locations from prior investigations (CDI, 2003; RA/TELLUS, 1999).

Hydrocarbon-impacted subsurface soil plumes were observed in five principal areas (Figure 4). These areas are characterized by estimated volumes greater than ten cubic yards of hydrocarbon-impacted subsurface soil exceeding the ADEC Method 2 DRO cleanup level. The areas are as follows:

- The former 3-inch diameter supply pipeline
- The former location of the primary 20,000-gallon capacity ASTs
- Buildings 202, 301, and Institute Avenue
- Buildings 201 and 210
- The intersection of Massin Avenue and Bay View Street

Additionally, there were four investigated areas with minimal extents of hydrocarbon-impacted soils. These areas are estimated to contain less than 10 cubic yards of soil above the ADEC Method 2 DRO cleanup level. These areas are as follows:

- The Intersection of Institute Avenue and Zimovia Highway
- Building 205
- Building 209
- Building 211

4.3.1.1 3-inch Diameter Supply Pipeline

The 3-inch diameter supply pipeline is located along the southern boundary of the property. The pipeline was observed on the ground surface and down to a depth of 6 inches. Approximately one-third of the pipeline is within the property; the remaining portion is located outside the fence and property boundary. The pipeline is comprised of 21-foot-long threaded segments of 3-inch-diameter steel pipe.

Subsurface soil samples were collected at 17 locations along the pipeline (Figure 3). Each sample was collected at a pipe joint junction. Because of the limited access and wetland status of the area off-property, the soil samples were collected by hand auger. Samples were analyzed by field screening and laboratory methods. Results are presented in Table 2.

The soil underlying the supply pipeline is predominantly silt and organic material (tundra mat). Sand and gravel underlies the silt at approximately 2 feet bgs. Hydrocarbon-impacted subsurface soil was observed at three areas along the supply pipeline (PJ-4 through PJ-6, PJ-11, and PJ-15 through PJ-17). Analytical samples collected from each of the areas had concentrations above ADEC cleanup levels (samples PJ-4-1.5, PJ-6-0.5, PJ-11-1.5, and PJ-15-0.5). The DRO concentrations exceeding the ADEC cleanup level in this area ranged from 1,400 mg/kg to 150,000 mg/kg.

The spatial extent of the contaminated soil is scattered, making volume estimates difficult; however, the estimated volume of in-place soil exceeding the ADEC DRO cleanup level is 180 cubic yards. This volume estimate includes three separate plumes with areas of 1,500, 290, and 1,400 square feet each (Figure 4) with an estimated thickness of 1.5 feet for each plume. Most of the impacted soil adjacent to the supply pipeline is within land tentatively designated wetlands, although this status is subject to U.S. Army Corps of Engineers review (Walsh Planning and Development Services, 2003).

Segments of the 3-inch supply pipeline are stacked at the eastern end of the line, near the former location of the primary 20,000-gallon ASTs. In addition, a drum is also located near PJ-12.

4.3.1.2 Former Location of the Primary 20,000-Gallon ASTs

The former location of the two primary 20,000-gallon ASTs is the southeastern corner of the Institute. The area is elevated approximately 6 feet above the natural grade. Hydrocarbon-impacted soil was observed on the surface and down to 3 feet bgs in the saturated silt-sand-gravel subsurface soil. Three analytical samples (TP-HH-2, TP-PP-1, and TP-DUP-4) averaged 4,666 mg/kg (Table 2).

The lateral extent of hydrocarbon-impacted soil is unknown along the south and southeastern boundary (Figure 4). This area has been tentatively designated wetlands, although the status is subject to U.S. Army Corps of Engineers review (Walsh Planning and Development Services, 2003). The northern extent of the hydrocarbon plume is limited by the sharp break in slope. The vertical extent is limited by the stiff, blue silt that underlies the gravel and effectively acts as an aquaclude, preventing the downward flow of groundwater (and petroleum hydrocarbons).

The volume of soil with hydrocarbon concentrations exceeding the ADEC Method 2 DRO cleanup level is estimated to be approximately 900 cubic yards (Figure 4). This volume estimate assumes a plume footprint with an area of 8,200 square feet and an average thickness of 3 feet.

4.3.1.3 Buildings 202, 301, and Institute Avenue

In 2001, approximately 200 cubic yards of hydrocarbon-impacted soil was removed from beneath Institute Avenue and 195 cubic yards was removed from beneath Building 202 (Girls Dormitory) (CDI, 2003). Confirmation samples from these two excavations indicated that hydrocarbon contamination could extend from the north side of Institute Avenue to Building 202. In addition, approximately 25 cubic yards of shallow, hydrocarbon-impacted soil was reported immediately south of Institute Avenue, near Building 301 (Hospital) (CDI, 2003).

During the current field effort, approximately 15 test pits were excavated near Buildings 202, 301, and Institute Avenue. Hydrocarbon contamination was observed in subsurface soils from the west side of Building 301 to the east side of the Building 202 and down to near the maple tree. The three highest DRO concentrations (TP-EE-3, TP-FF-6, and TP-T-1) averaged 1,933 mg/kg (Table 2). The lateral extent of the soil plume is presented in Figure 4. The vertical extent is limited by the stiff, blue silt, which was observed between 4 and 7 feet bgs in the area. Depth to groundwater was observed at the same interval of 4 to 7 feet bgs.

The in-place volume of soil with hydrocarbon concentrations exceeding the ADEC Method 2 DRO cleanup level is estimated to be approximately 3,000 cubic yards (Figure 4). This volume estimate assumes a plume footprint of 18,500 square feet and a thickness ranging from 2 feet to 7 feet.

4.3.1.4 Buildings 201 and 210

Buildings 201 (Main School) and 210 (Dining Hall) were located in the middle of the Institute property on Bay View Street. In 1999, a total of approximately 259 cubic yards of soil was removed from the UST locations (Tanks 7 and 8) (RA/TELLUS, 1999). In 2001, an additional 20 cubic yards of contaminated soil was removed from the former UST location at Building 210 (Tank 8). Confirmation samples indicated that hydrocarbon-impacted soil extended westward from the excavation for an unknown distance downgradient of Building 210, toward Shoemaker Bay (CDI, 2003).

In November 2003, approximately 12 test pits were excavated near the former locations of Buildings 201 and 210 (Figure 3). Hydrocarbon-impacted subsurface soil was observed in test pits at two former UST locations, Building 210 (TP-QQ) and Building 201 (TP-II), and extending approximately 150 feet downslope to TP-QQ. The two soil samples with the highest DRO concentrations were TP-I-8 (2,800 mg/kg) and TP-P-6 (6,300 mg/kg). The maximum vertical extent of the hydrocarbon contamination was observed at location TP-I, where impacted soils extended from 2 feet to 8 feet bgs. Excavation of the test pit was halted at 8 feet bgs, where groundwater was encountered.

The in-place volume of soil with hydrocarbon concentrations exceeding the ADEC Method 2 DRO cleanup level is estimated to be approximately 1,400 cubic yards (Figure 4). This volume

estimate assumes a plume footprint with an area of 7,600 square feet and an average thickness of 5 feet. The groundwater samples collected in this area also exceeded ADEC cleanup levels (refer to Section 4.3.2).

4.3.1.5 Intersection of Massin Avenue and Bay View Street

In 2001, CDI removed approximately 700 cubic yards of contaminated soil between Building 205 and the intersection of Bay View Street and Massin Avenue. Analysis of confirmation sample results indicated that a 3-way pipeline junction located immediately north-northwest of the intersection was the probable cause of hydrocarbon contamination (CDI, 2003).

In 2003, thirteen samples were collected near the 3-way pipeline junction at the intersection of Bay View Street and Massin Avenue. At portions of test pits TP-D and TP-G, hydrocarbon-impacted soil extends continuously from the surface to 3 feet bgs and discontinuously from 3 feet to 7 feet bgs. Sample results are presented in Table 2. The soil is a well-graded silt-sand-gravel mixture (USCS classification GW). Maximum depth to groundwater is 2 feet bgs, and is characterized by near-artesian or near-spring conditions.

The in-place volume of soil with hydrocarbon concentrations exceeding the ADEC Method 2 DRO cleanup level is estimated to be approximately 400 cubic yards (Figure 4). This volume estimate assumes a plume footprint of 2,100 square feet and an average thickness of 5 feet. Due to the shallowness of the groundwater in the area, vertical extent of hydrocarbon contamination of subsurface soil is difficult to assess.

4.3.1.6 Building 205

In 2001, approximately 700 cubic yards of contaminated soil was removed from Building 205 and the area immediately uphill. Three of nineteen confirmation samples contained DRO concentrations exceeding the ADEC Method 2 DRO cleanup level. One of the samples was reportedly mixed with other material during the foundation removal in September 2001. Another sample, and its duplicate, was associated with a thin (approximately 3-inch) layer of contamination. CDI concluded that the hydrocarbon-impacted soil remaining in-place at Building 205 would be difficult to locate and estimated the volume of in-place contaminated soil to be 10 cubic yards (CDI, 2003).

In 2003, test pits were excavated at three locations near the former footprint of Building 205: directly below the footprint (TP-B), downgradient of the footprint (TP-C), and upgradient of the footprint (TP-E). No obvious hydrocarbon staining or odor was observed in the subsurface soil at the three test pits; however, a sheen was observed in groundwater at the bottom of TP-B, below an exposed concrete pad. Samples were collected adjacent to the pad (TP-B-3), underneath the concrete pad (TP-B-7), and downgradient of the pad (TP-C-3 and TP-C-11). Sample results are presented in Table 2. The analytical results from samples near Building 205 were below ADEC cleanup levels and the highest PetroFlag result was 517 ppm. This data suggests that there is minimal subsurface soil contamination near Building 205.

4.3.1.7 Building 211

In 1999, RA/TELLUS removed the UST and approximately 49 cubic yards of contaminated soil at Building 211, the Principal's Residence. Two confirmation samples collected below the tank contained concentrations exceeding the ADEC Method 2 DRO cleanup level (RA/TELLUS, 1999).

During the current investigation, a test pit (TP-A) was excavated under the former location of the UST at Building 211. Soil samples were collected from three depth intervals. Sample results are presented in Table 2. Field observations and analytical data indicate that the subsurface soil nearest groundwater (9-10 feet bgs) exceeds ADEC cleanup levels. The soil/backfilled material above this zone is not impacted with hydrocarbons. Consequently, the in-place volume of hydrocarbon-impacted subsurface soil at the former location of Building 211 is estimated at less than 10 cubic yards.

4.3.1.8 Building 209

In 1999, RA/TELLUS removed the UST and approximately 42 cubic yards of contaminated soil at the former location of Building 209, the South Staff Residence (RA/TELLUS, 1999). In 2001, hydrocarbon-impacted soil was observed near the center of the building footprint. An additional 60 cubic yards was removed from the area. Two confirmation samples were below ADEC Method 2 cleanup levels (CDI, 2003).

In 2003, a trench was excavated at the center of the former footprint of Building 209. Two samples (TP-DD-4 and TP-DD-5) were collected; the sample results were below ADEC cleanup levels (Table 2). Consequently, field observations and sample data indicate that the former location of Building 209 does not contain hydrocarbon-impacted soil above ADEC method 2 cleanup levels.

4.3.1.9 Intersection of Zimovia Highway and Institute Avenue

In 2001, test pits indicated that the coarse roadbed material underneath Institute Avenue provided a preferential pathway for hydrocarbon contamination and migration (CDI, 2003). Approximately 200 cubic yards of contaminated soil was removed from the roadbed. Five confirmation samples were collected. One sample, collected at 3 feet bgs near the intersection of the fence and the roadbed, exceeded ADEC cleanup levels (CDI, 2003).

In 2003, two trenches were excavated on each side of the Institute Avenue roadbed immediately outside the fence. The excavations were in native soil. No hydrocarbon-impacted soil was observed. Two samples collected from the test pits (TP-Z-5 and TP-AA-5) did not contain detectable concentrations of DRO (Table 2). This data suggests that potential impacted subsurface soil at this site is limited in aerial extent and is located within the Institute Avenue roadbed.

4.3.2 Groundwater Quality

The groundwater monitoring well locations, as shown on Figure 3, are as follows:

- Seven wells (MW-3, MW-4, MW-5, MW-6, MW-8, MW-9, and MW-10) were sited downgradient of known source areas, with two of these wells off-property between the Zimovia Highway and Shoemaker Bay.

- Two wells (MW-1 and MW-2) were installed adjacent to Institute Creek; one of these also monitors for potential groundwater impacts from the gasoline UST (Tank 2) historically located adjacent to the creek.

- One off-property monitoring well (MW-7) was installed at the presumed historical fuel off-loading area at the west terminus of the 3-inch fuel line on the south side of the property.

Upon completion of installation and development of the groundwater monitoring wells, groundwater samples were collected from new monitoring wells and the two water supply wells on site. Sample results are presented in Table 3.

DRO was detected in groundwater samples from five monitoring wells (MW-2, MW-4, MW-5, MW-6, and MW-7); however, samples from only two wells (MW-4 and MW-5) contained concentrations exceeding the ADEC cleanup levels (Table C, 18 AAC 75) and water quality criteria (18 AAC 70). The hydrocarbon-impacted groundwater at MW-4 and MW-5 most likely reflects an area of contiguous groundwater contamination, as illustrated on Figure 5. The plume may extend approximately 270 feet down slope to the northwest, where hydrocarbon-impacted, water-saturated soil was observed at 10 feet bgs. Soil sampled from that location (TP-A-9 and TP-A-10) contained values at (or above) the ADEC Method 2 DRO cleanup level.

Groundwater samples from five monitoring wells (MW-2, MW-3, MW-4, MW-5, and MW-6) exceeded ADEC cleanup levels (Table C, 18 AAC 75) for one or more PAH constituents, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene.

Hydrocarbon constituents were not detected in samples from the water supply wells, which both exhibited confined/artesian conditions. The total depth of these wells is reportedly greater than 100 feet (Caldwell, 2003).

4.3.3 Surface Water Quality

A surface water spring/seep survey was conducted in the areas downslope from petroleum-impacted soils. Ten surface water samples (plus two duplicates) were collected. The sample locations were as follows (Figure 3):

- One on-property location near an area with known hydrocarbon-impacted soils (SW-1)

- Six off-property locations downgradient of areas with known hydrocarbon-contaminated soil (SW-2, SW-4, SW-5, SW-7, SW-8, and SW-10)

- Three locations along Institute Creek: two outfalls from the Institute (SW-3 and SW-6) and one creek outlet to Shoemaker Bay (SW-9)

Concentrations of hydrocarbons in surface water samples are presented in Table 3. At two locations, SW-1 and SW-5, benzo(b)fluoranthene was detected at concentrations exceeding the surface water cleanup level. Other surface water results did not exceed ADEC surface water cleanup levels, although visible sheens were noted in several samples (SW-2, SW-4, SW-5, and SW-7), and detectable concentrations of other petroleum compounds were present (Table 3).

4.3.4 Surface Sediment Quality

Surficial sediment samples were collected from the same locations as the surface water samples. The surface sediment observations and analytical results are presented in Table 4. DRO concentrations in surface sediment samples SED-4, SED-5, SED-7, and SED-10 exceeded ADEC Method 2 cleanup levels. All of these locations are in the drainage adjacent to the 3-inch supply pipeline (Figure 3). The sample with the highest DRO concentration, SED-4, also exceeded the ERM for 2-Methylnaphthalene.

4.3.5 Stockpile Assessment

Soil preciously excavated from the Institute has been placed in two temporary stockpiles: the RA/TELLUS stockpile and the CDI stockpile.

The RA/TELLUS stockpile, currently located at a city-owned rock quarry, contains 750 cubic yards of material excavated by RA/TELLUS in 1999 (Figure 1). In 2001, CDI submitted ten samples (plus one duplicate) for DRO analysis. DRO concentrations ranged from 730 mg/kg to 1,900 mg/kg. Five of the samples were analyzed for BTEX, none of which exceeded ADEC Method 2 cleanup levels (CDI, 2003). In 2003, SLR observed that the top liner is positioned on the side of the stockpile and no longer covers the soil.

The CDI stockpile is located approximately ¼ mile north of the Institute and contains 1,300 cubic yards of contaminated soil (Figure 2). In 2001, seven samples of stockpiled soil from the Building 205 excavation were collected. DRO concentrations of the samples ranged from 310 mg/kg to 5,300 mg/kg. One sample (out of three) analyzed for BTEX exceeded the ADEC Method 2 cleanup level for benzene (CDI, 2003).

In November 2003, four stockpile samples (and one duplicate) were collected from the soil in the CDI stockpile believed to have been excavated from areas other than Building 205. The sample results are presented in Table 5. DRO concentrations ranged from 1,100 mg/kg to 1,200 mg/kg. No BTEX concentrations exceeded ADEC Method 2 cleanup levels. The stockpile is in generally good condition, although the top liner has partially separated and exposed the underlying soil (Appendix B, Photo 13).

5 EVALUATION OF TREATMENT AND DISPOSAL OPTIONS

The information collected during the 2003 site characterization, as well as information from prior site investigations, was used to develop recommendations to ADEC for potential remediation options.

5.1 Remediation Options

The following options were identified as potential remediation options for the existing contaminated soil originating at the Institute:

- Excavation, shipment, and disposal off-site at a landfill or treatment facility licensed to dispose of this hazardous material
- Excavation and local thermal remediation
- Excavation and local encapsulation
- Excavation and local biological treatment

In situ treatment options, such as air stripping and enhanced biological degradation by the addition of oxygen to the subsurface, were considered but were found to be inappropriate for this site. Air stripping would be effective in removing volatile hydrocarbon constituents; however, the contamination in the area consists of diesel, which is largely comprised of semi-volatile and non-volatile compounds. In situ biological treatment would probably require installation of extensive piping and mechanical systems at the site and would require a long-term effort to reach the remediation goals. In situ remediation is most appropriate at sites where excavation is costly or not feasible, which is not the case at the Institute.

The total volume of soil used in the remediation cost estimate is the volume of soil currently stockpiled, 2,050 cubic yards. The total weight of this soil, assuming 1.5 tons per cubic yard, is estimated to be 3,075 tons.

The treatment options included in the analysis, their applicability, advantages, and disadvantages, are discussed below.

5.1.1 Off-Site Treatment or Disposal

Off-site treatment and disposal constitutes transferring the contaminated soil in the stockpiles into open-top containers and shipping by barge to the nearest treatment or disposal facility licensed to accept petroleum-contaminated material.

Off-site treatment or disposal results in the immediate removal of exposure of contaminated material to the environment or human health. The location of the Institute is advantageous for low-cost marine transportation, as well as proximity to treatment or disposal facilities in Washington State. In addition, off-site disposal or treatment can be done at a relatively fixed unit cost, which is generally an advantage for remediation of relatively low volumes of material.

Off-site treatment and disposal has the disadvantage of likely not providing benefit to the local economy to the degree that local remediation options would. In addition, it is possible that at some soil volume, economies of scale would be such that the unit cost to ship the soil to an off-site facility would exceed the unit treatment cost of treating the soil locally.

The cost for off-site disposal is based upon a unit cost for transportation from Wrangell to the disposal facility and disposal of $50 per ton. In addition, handling costs to dismantle the stockpile and transport the soil to the barge in Wrangell are estimated to be $20/ton. The total per ton cost is estimated to be approximately $70, for a total cost of $215,250 for disposal of the existing stockpiles. This price is based on the assumption that the existing site characterization and stockpile sampling data is adequate to characterize the soil as non-hazardous, and that no additional characterization would be necessary.

5.1.2 On-Site Thermal Remediation

On-site thermal remediation can be accomplished with either a soil burner or a hot air vapor extraction system (HAVE). Thermal remediation would result in nearly complete destruction of petroleum hydrocarbons in the nonorganic soil found at the Institute.

Mobilization and energy costs for thermal remediation would be significant, as diesel fuel would be the fuel used at the Institute site. Additional costs may be incurred depending upon the ultimate disposal of the remediated soil. Thermally remediated soil is generally not aesthetically suitable for surface use, the exposed soil becomes a source of nuisance dust in windy conditions, and the very low moisture content of the soil makes it unsuitable for use as load-bearing fill material. Beneficial reuse of the thermally treated soil may include non-structural fill material, such as landfill cover. It is possible to rehydrate the soil to make it suitable for structural use such as fill in a civics works or other construction use; however, this would incur additional costs.

The estimated cost for mobilization and demobilization for a soil burner or HAVE system to Wrangell is estimated to be $50,000. The unit cost for thermal remediation is estimated to be $70 per ton. In addition, third-party confirmation sampling is necessary after thermal remediation to verify ADEC cleanup levels have been met, and the assumed cost for labor and laboratory analyses for this sampling is $20,000. The total cost for thermal remediation of the existing stockpiles is $285,250, not including any consequent costs for handling or re-hydrating the remediated soil.

5.1.3 On-Site Encapsulation

With the approval of the ADEC, the petroleum-contaminated soil could be encapsulated in a roadbed, under the conditions detailed in 18 AAC 75.360(11)(G). Encapsulation would most

easily be implemented if a paved roadway was constructed and the contaminated material could be incorporated in the center of the roadbed. An advantage to this method includes very low unit soil disposal cost. Disadvantages of this method would include limited road construction work taking place in Wrangell, the potential necessity for long-term monitoring of ground and surface water adjacent to the encapsulation area, and the burden of long-term liability of the contaminated material if the roadbed was reconstructed or abandoned.

Future roadwork in Wrangell includes reconstruction of the Wrangell Airport access road and parking lot by the Alaska Department of Transportation and Public Facilities (ADOT&PF), which is currently in the planning phase (Hughes, 2004), and reconstruction of a 1000-foot stretch of Cassiar Street in Wrangell during the 2004 construction season (Caldwell, 2004). Both of these projects involve streets in a relatively urban setting that include utilities in the road prism and are in close proximity to homes or businesses. At this time, it appears unlikely that the ADOT&PF road reconstruction would be an encapsulation alternative because of the presence of water wells near the construction area, and the presence of utilities in the road prism (Hughes, 2004). Encapsulation in the Cassiar Street roadbed would, in addition to approval from ADEC with respect to environmental impacts, be dependent upon the volume of soil required for street reconstruction, the suitability of the stockpile soil as roadbed material, and public acceptance.

The estimated cost for dismantling the stockpile and placing the soil in a roadbed is estimated as $20/ton. In addition, a leaching assessment would need to be done for the location selected, which is estimated to cost $10,000. It is assumed that three groundwater monitoring wells would need to be installed and sampled annually for at least 2 years, for which the estimated cost is $20,000. The total cost for the on-site encapsulation option by placement in a roadbed is estimated to be $91,500.

5.1.4 On-Site Biological Treatment

On-site biological treatment could be accomplished by two methods, either in a covered and lined biological treatment cell (biocell), or in a lined landfarming area.

The biocell option would require three four biocells, assuming a total soil volume of 2,000 cubic yards and a typical individual biocell volume of 500 to 750 cubic yards, require three four biocells. Alternately, a single biocell could be used through which soil would be cycled over a longer period of time. The footprint for a typical biocell is 50 feet by 60 feet. The biocell(s) would require a blower, either a recursive or direct-displacement (roots) type, to supply oxygen to the soil. In addition, the biocell may require an irrigation system to supply moisture and nutrients to the soil, or a leachate collection system to drain excess moisture. If electrical service could be supplied for a reasonable cost, the current location of the CDI stockpile would be a feasible location for a biocell. Alternately, an electrical drop is present on the northwest side of the Institute property, and depending upon planned land use, it may be feasible to activate this electrical drop and construct the biocell at this location.

The estimated cost to construct and operate the biocell was estimated using the Biopile Cost Estimator Version 3 (Battelle, 2000). The treatment cost per cubic yard, including biocell construction and operation and maintenance for a total treatment time of 8 months, assuming no utility, land rental, travel, or shipping costs, was estimated to be $65. This cost was adjusted

upward by 20% to estimate inflation since the software parameters were established in 2000, resulting in a per-yard cost of $78. A flat rate of $20,000 for shipping the biocell construction materials to Wrangell was assumed. In addition, travel and per diem costs of $20,000 were assumed for environmental contractor technicians and project managers to travel to Wrangell for system construction and for routine sampling and respiration testing. It was assumed that routine operation and maintenance could be accomplished locally. The cost to dismantle the stockpiles and transport the soil to the biocell is assumed to be $20/cubic yard. The estimated electrical cost, assuming each blower is 2 horsepower, 24-hour operation for eight months, and electrical costs of $0.25 per kilowatt hour, $8,700. Dismantling costs for the stockpiles are assumed to be a lump sum of $20,000. The total cost for the biocell treatment option, assuming remediation is accomplished in a single season, is estimated to be $269,600.

The landfarming option consists of constructing a lined landfarming area, applying clean cover soil above the liner, and then applying an approximate 18-inch lift of contaminated soil. Nutrients are applied to the soil, which is then aerated with an agricultural tractor and rotary tiller. Given the annual precipitation in Wrangell, a leachate collection and treatment system would likely be necessary. Assuming the contaminated soil volume of 2,050 cubic yards, the landfarming area would require a footprint of 36,000 square feet (0.7 acres), which could be accommodated within the Institute property. The cost to construct a liner and leachate collection and treatment system for this area would be considerable. The time to clean up for this method is variable, with landfarming providing excellent aeration of volatile hydrocarbon compounds, followed by slower biological decay of residual hydrocarbons. The landfarming process is relatively sensitive to soil moisture and air temperature, and effectiveness would consequently depend upon seasonal conditions at the time of treatment.

The estimated cost for the landfarming option is approximately $2 per square foot for liner purchase and placement for the landfarming area, or $72,000. The leachate collection system is estimated to cost an additional $10,000 for installing a French drain system and rental or purchase of pumps to transfer the leachate to holding tanks/truck. Soil placement costs are estimated as $20 per cubic yard. Treatment or disposal of the leachate from the collection system is estimated to cost approximately $180,000 annually, based on the assumption that the entire annual precipitation would be captured over the 36,000 square foot area, for a total estimated volume of 1.8 million gallons of water, and further assuming that the water could be treated at the local water treatment system or with a portable granular activated carbon system for a total cost of collection, shipping, and treatment cost of $0.10/gallon. Annual landfarming costs, including equipment rental, nutrients, and local labor to treat the soil, are estimated to cost $25/cubic yard per year. The total cost for the first year of landspreading is estimated to be $354,250.

The landfarming treatment option is assumed to require 3 years based on knowledge of landfarming of soil with similar contamination in the Anchorage and Kenai Peninsula area. The cost for each additional year of landfarming treatment is estimated to be $231,250.

Confirmation sampling after completion of the landfarming activities is assumed to cost approximately $20,000, including labor, laboratory, and reporting costs. It is assumed that the landspreading area would be left in place after treatment is complete.

5.2 Remediation Options Ranking

SLR used the criteria outlined in the USEPA Comprehensive Environmental Response Compensation and Liability Act (CERCLA) feasibility study process (USEPA, 1988) to rank various approaches or combinations of approaches. These criteria include the following:

- Overall protection of human health and the environment
- Compliance with applicable, relevant, appropriate requirements
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Short-term effectiveness
- Implementability
- Cost
- State and community acceptance

The treatment options were ranked on a scale of one to five, as follows:

1. Poor applicability
2. Moderate applicability
3. Average applicability
4. Good applicability
5. Excellent applicability

The treatment options are summarized with respect to each of the above criteria in Table 6. The analysis indicates that the remediation options that would best be applied to this site are off-site disposal or treatment, followed by thermal treatment, roadbed encapsulation, biological treatment in a biocell, and finally, biological treatment by landfarming.

6 CONCLUSIONS

The ADEC contracted SLR to conduct soil, surface water, and groundwater sampling at the Institute in Wrangell, Alaska. This report summarizes the historical land use and site assessments, the recent site assessment, and recommendations for future remedial and disposal actions.

The subsurface soil investigation focused on areas with hydrocarbon-impacted soil known to exceed ADEC cleanup levels as specified in Title 18, Chapter 75, Section 341 of the Alaska Administrative Code (18 AAC 75.341). These areas include former locations of USTs and the interconnecting underground pipeline system. Hydrocarbon-impacted subsurface soil was observed in five principal areas within, or immediately outside, the Institute property. These plumes encompass an estimated 5,880 cubic yards of soil exceeding the ADEC Method 2 DRO cleanup level. Portions of the impacted soil are within land tentatively designated for wetlands status, although the status is subject to U.S. Army Corps of Engineers review (Walsh Planning and Development Services, 2003).

Groundwater was sampled in ten newly constructed monitoring wells and two existing water supply wells. DRO concentrations in two on-property monitoring wells exceeded 18 AAC 75.345 Table C values. In addition, groundwater sample results from five monitoring wells exceeded ADEC PAH cleanup levels.

Surface water and sediment samples were collected at ten locations around the Institute perimeter. Two surface water sample results exceeded ADEC cleanup levels for benzo(a)pyrene. Four sediment sample results exceeded the ADEC Method 2 DRO cleanup level. All the sediment samples exceeding the DRO cleanup levels are adjacent to or downgradient of the 3-inch supply pipeline. The sample with the highest DRO concentration, SED-4, also exceeded the ERM for 2-Methylnaphthalene.

In addition to the estimated 5,880 cubic yards of in-place soil exceeding the DRO cleanup level, approximately 2,050 cubic yards total of soil is stored in two stockpiles that require treatment and/or disposal (CDI, 2003; RA/TELLUS, 1999). Analysis indicates that the remediation options that would best be applied to this site are off-site disposal or treatment, followed by thermal treatment, roadbed encapsulation, biological treatment in a biocell, and finally, biological treatment by landfarming.

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LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.

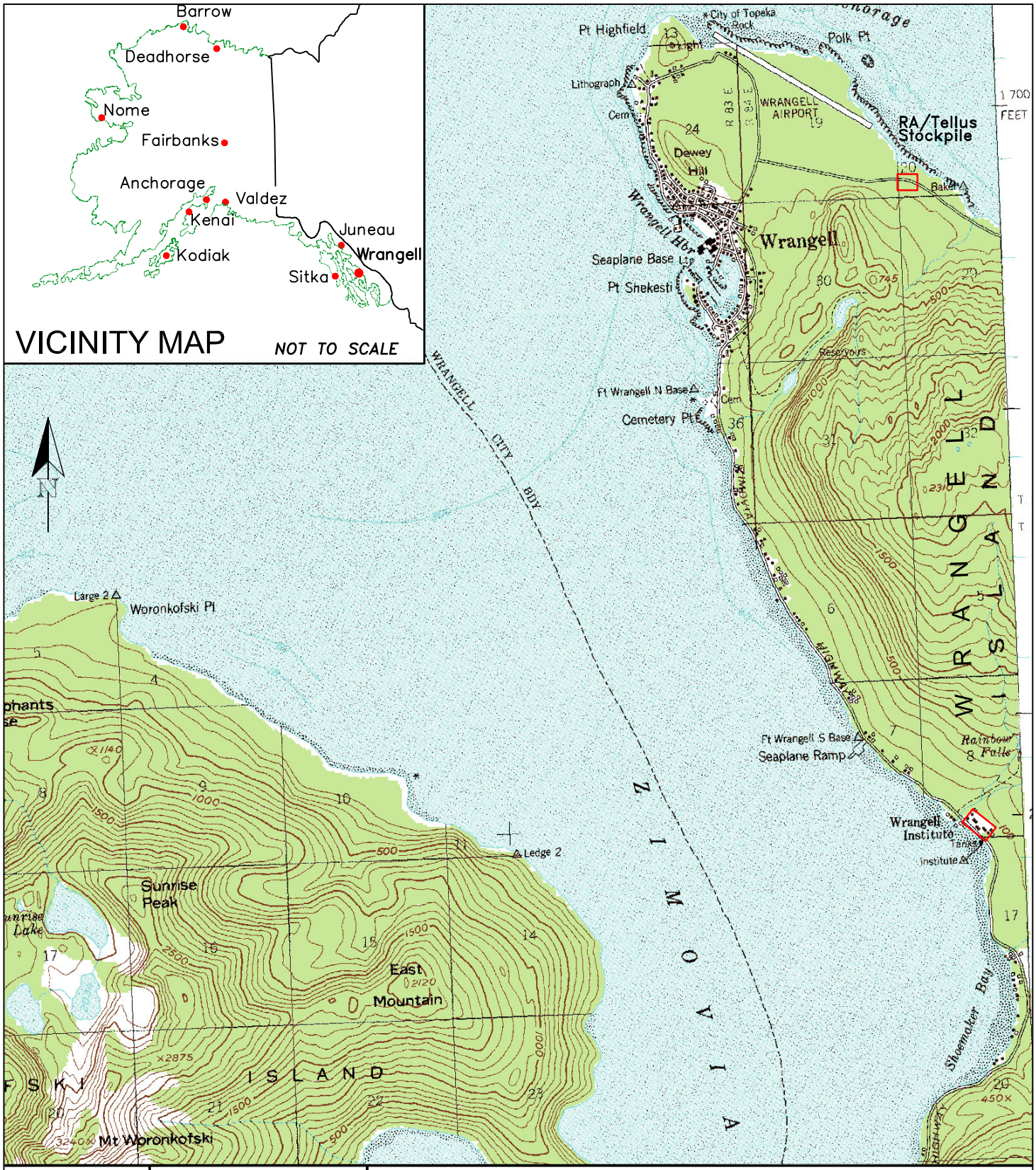
The purpose of an environmental assessment is to reasonably evaluate the potential for or actual impact of past practices on a given site area. In performing an environmental assessment, it is understood that a balance must be struck between a reasonable inquiry into the environmental issues and an exhaustive analysis of each conceivable issue of potential concern. The following paragraphs discuss the assumptions and parameters under which such an opinion is rendered.

No investigation is thorough enough to exclude the presence of hazardous materials at a given site. If hazardous conditions have not been identified during the assessment, such a finding should not therefore be construed as a guarantee of the absence of such materials on the site, but rather as the result of the services performed within the scope, limitations, and cost of the work performed.

Environmental conditions may exist at the site that cannot be identified by visual observation. Where subsurface work was performed, our professional opinions are based in part on interpretation of data from discrete sampling locations that may not represent actual conditions at unsampled locations.

Except where there is express concern of our client, or where specific environmental contaminants have been previously reported by others, naturally occurring toxic substances, potential environmental contaminants inside buildings, or contaminant concentrations that are not of current environmental concern may not be reflected in this document.

FIGURES



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Alaska Department of Environmental Conservation

WRANGELL INSTITUTE SITE ASSESSMENT
WRANGELL, ALASKA
ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SITE LOCATION MAP

PROJECT MANAGER:	APPROVED:	DESIGNED:	SCALE:	REVISION:	FIGURE:
M. RIESER	R. KLIEFORTH	K. BOYESEN		0	1
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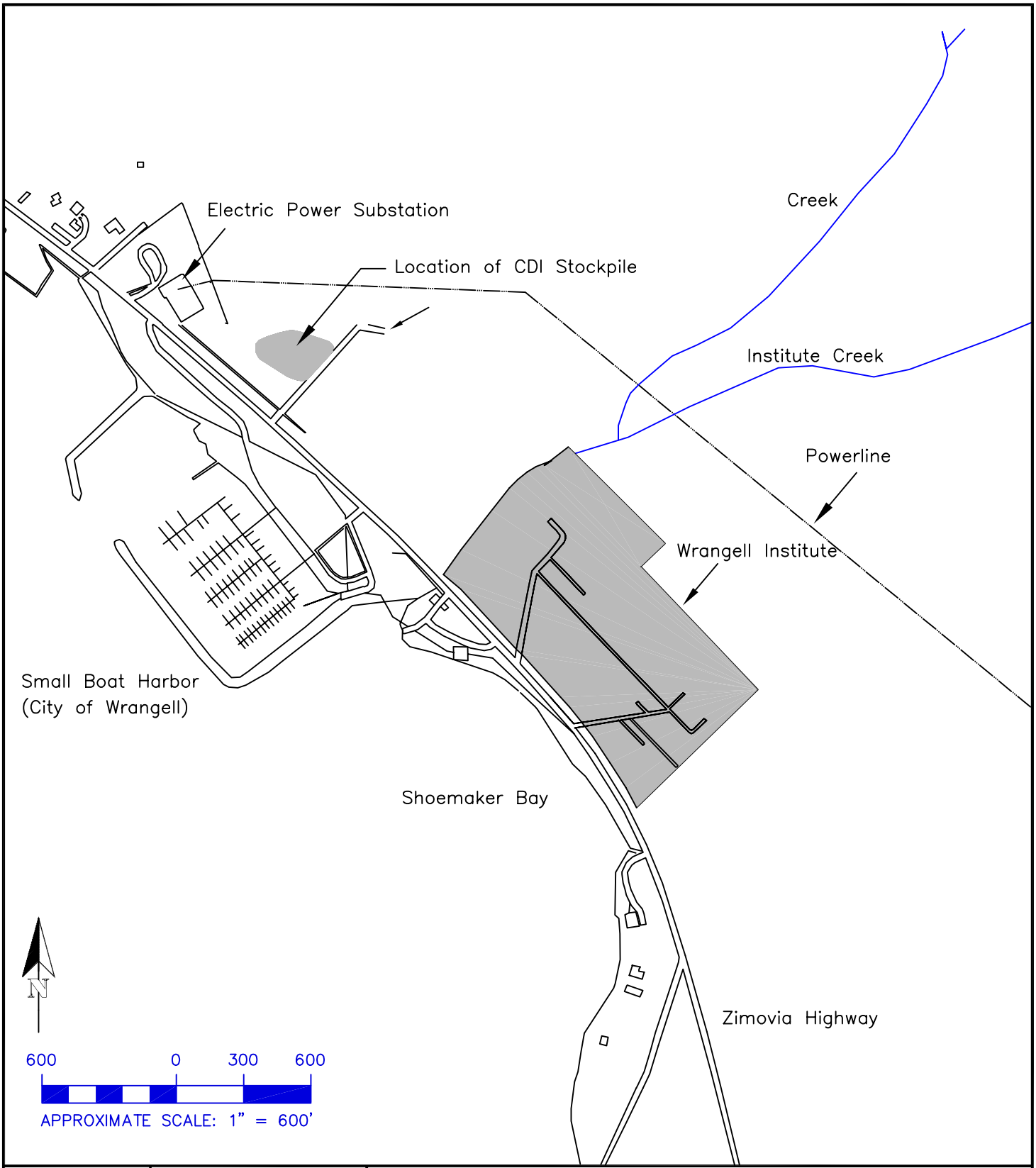

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WRANGELL, ALASKA
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SITE LAYOUT

PROJECT MANAGER:	APPROVED:	DESIGNED:	APPROX. SCALE:	REVISION:	FIGURE:
M. RIESER	R. KLIEFORTH	K. BOYESEN	1" = 600'	0	2
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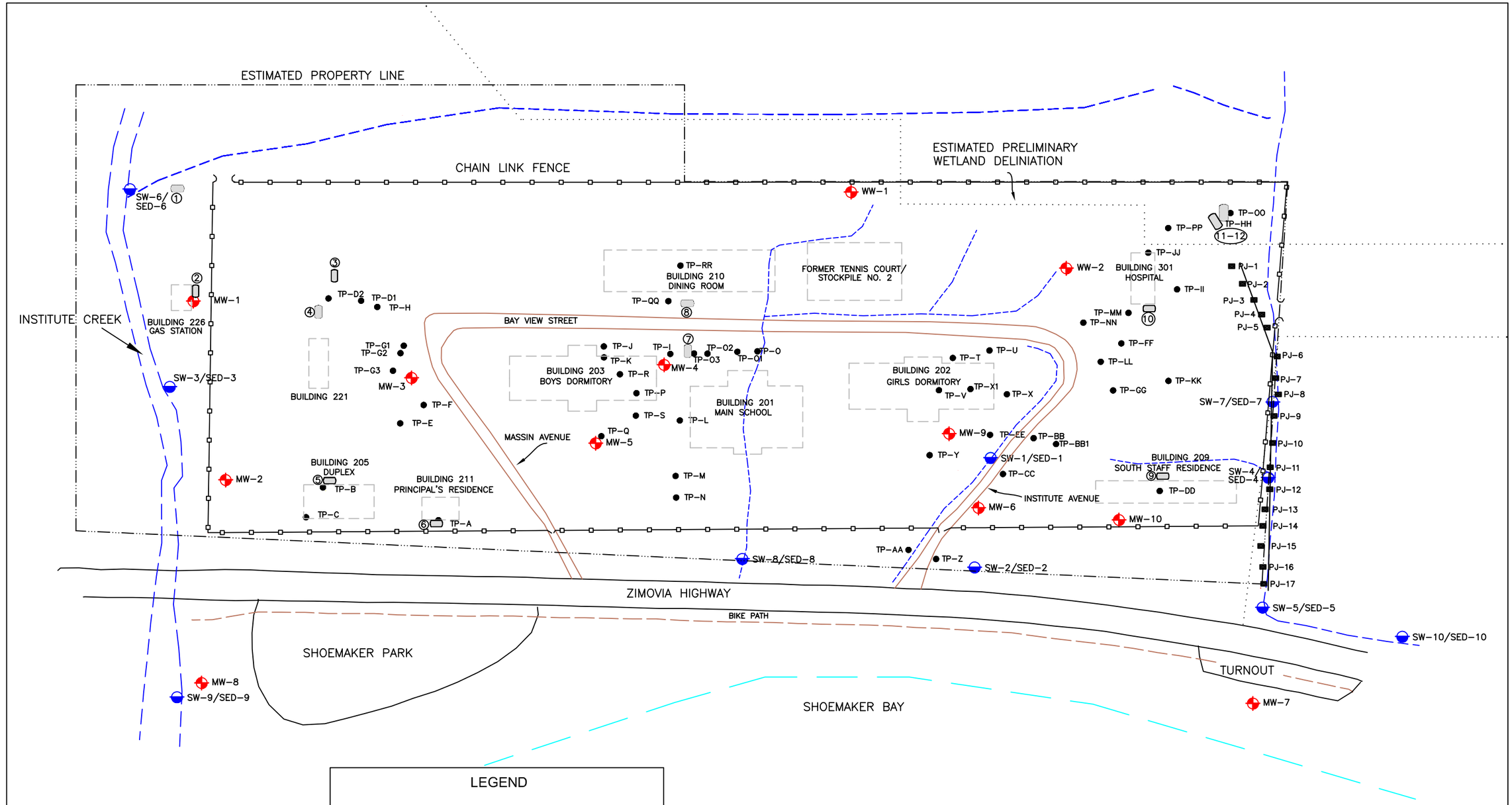

NOTE:
DRAWING BASED ON CARSON DORN INC. APRIL 2003 AND WALSH PLANNING & DEVELOPMENT SERVICES MAY 2003.

LEGEND

- TEST PIT LOCATION
- 3-INCH SUPPLY PIPELINE SAMPLE LOCATION
- 3-INCH SUPPLY PIPELINE
- GROUNDWATER MONITORING WELL
- SURFACE WATER SAMPLE LOCATION AND SEDIMENT SAMPLE LOCATION
- FORMER HEATING OIL AND GASOLINE TANK LOCATION AND IDENTIFICATION
- FOOTPRINT OF FORMER INSTITUTE BUILDINGS
- SURFACE WATER DRAINAGE

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SAMPLE LOCATION MAP

PROJECT MANAGER:	APPROVED:	DESIGNED:	SCALE:	REVISION:	FIGURE:
M. RIESER	R. KLIEFORTH	R. KLIEFORTH	1" = 100'	0	3
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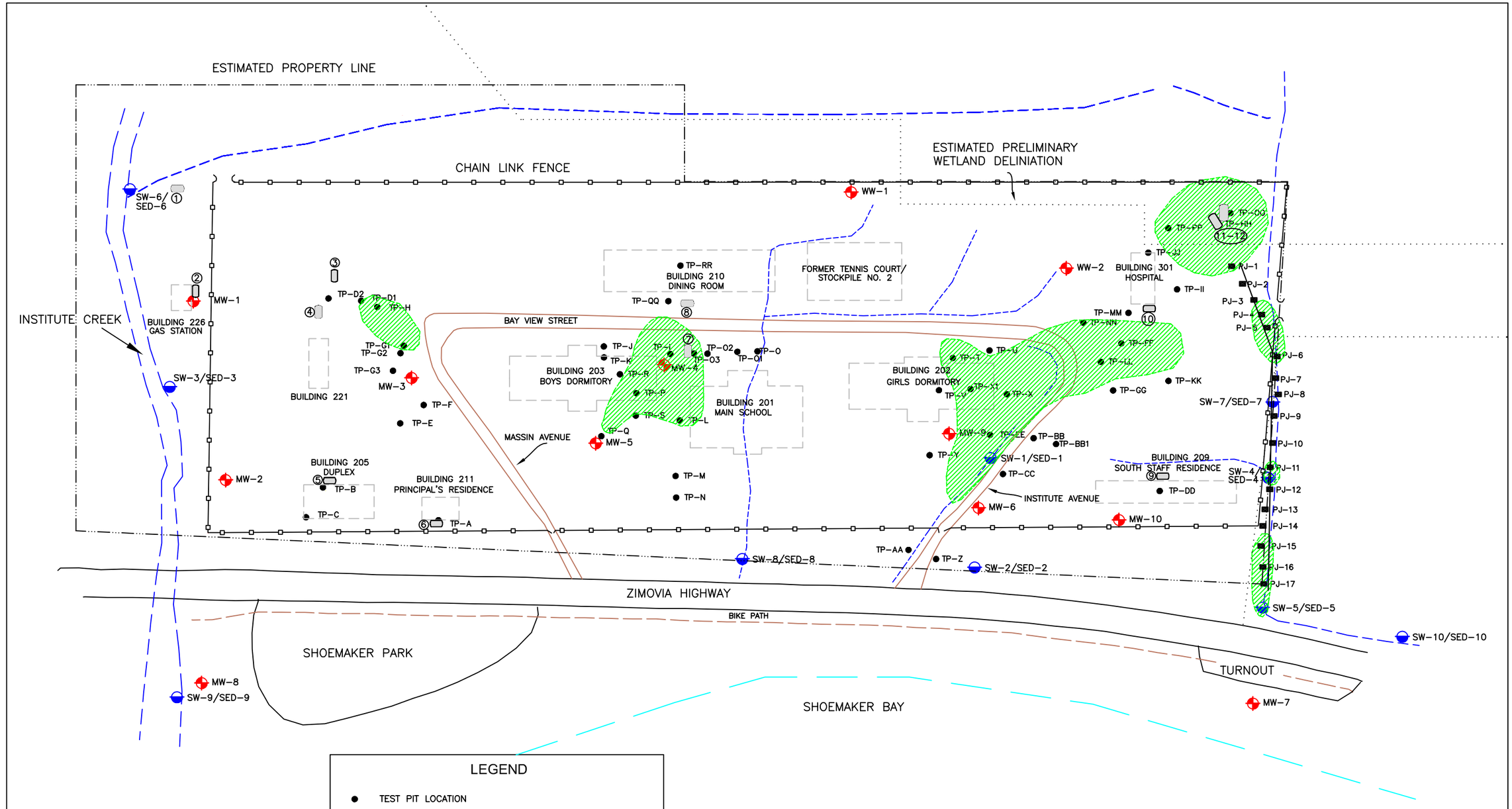

NOTE:

DRAWING BASED ON CARSON DORN INC. APRIL 2003 AND WALSH PLANNING & DEVELOPMENT SERVICES MAY 2003.

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SCALE: 1" = 100'

LEGEND

- TEST PIT LOCATION
- 3-INCH SUPPLY PIPELINE SAMPLE LOCATION
- 3-INCH SUPPLY PIPELINE
- GROUNDWATER MONITORING WELL
- SURFACE WATER SAMPLE LOCATION AND SEDIMENT SAMPLE LOCATION
- FORMER HEATING OIL AND GASOLINE TANK LOCATION AND IDENTIFICATION
- FOOTPRINT OF FORMER INSTITUTE BUILDINGS
- SURFACE WATER DRAINAGE
- ESTIMATED EXTENT OF HYDROCARBON SOIL CONTAMINATION EXCEEDING ADEC METHOD 2 DRO CLEANUP LEVEL

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ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

WRANGELL INSTITUTE SITE ASSESSMENT
WRANGELL, ALASKA
ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

SOIL PLUMES EXCEEDING ADEC METHOD 2 DRO CLEANUP LEVEL

PROJECT MANAGER:	APPROVED:	DESIGNED:	SCALE:	REVISION:	FIGURE:
M. RIESER	R. KLIEFORTH	R. KLIEFORTH	1" = 100'	0	4
PROJECT NO.:	DRAWN:	DATE:	FILE:		
005.0065.03003	K. BOYESEN	JANUARY 2004	S:\Project\ADEC\Wrangell\Report		

ESTIMATED PROPERTY LINE

ESTIMATED PRELIMINARY WETLAND DELINIATION

CHAIN LINK FENCE

SW-6/SED-6 ①

WW-1

BUILDING 301 HOSPITAL

⑪-⑫

BUILDING 210 DINING ROOM

FORMER TENNIS COURT/ STOCKPILE NO. 2

WW-2

INSTITUTE CREEK

BUILDING 226 GAS STATION

MW-1 23.31

BAY VIEW STREET

⑩

SW-3/SED-3

BUILDING 221

MW-3 32.32

BUILDING 203 BOYS DORMITORY

MW-4 32.94

BUILDING 202 GIRLS DORMITORY

BUILDING 201 MAIN SCHOOL

SW-7/SED-7

MW-9 40.36

MASSIN AVENUE

MW-5 28.06

SW-1/SED-1

BUILDING 205 DUPLEX

BUILDING 211 PRINCIPAL'S RESIDENCE

BUILDING 209 SOUTH STAFF RESIDENCE

SW-4/SED-4

MW-2 15.68

INSTITUTE AVENUE

MW-6 29.77

36.45 MW-10

SW-8/SED-8

SW-2/SED-2

ZIMOVIA HIGHWAY

BIKE PATH

SW-5/SED-5

SW-10/SED-10

SHOEMAKER PARK

7.69 MW-8

SW-9/SED-9

TURNOUT

MW-7 10.37

SHOEMAKER BAY

ZIMOVIA STRAIGHT

LEGEND

- GROUNDWATER MONITORING WELL (DRO CONCENTRATION ABOVE ADEC TABLE C, 18 AAC 75 CLEANUP LEVEL)
- GROUNDWATER MONITORING WELL (DRO CONCENTRATION BELOW ADEC TABLE C, 18 AAC 75 CLEANUP LEVEL)
- GROUNDWATER PAH CONCENTRATION ABOVE ADEC TABLE C, 18 AAC 75 CLEANUP LEVELS
- GROUNDWATER PAH CONCENTRATION BELOW ADEC TABLE C, 18 AAC 75 CLEANUP LEVELS
- SURFACE WATER SAMPLE LOCATION AND SEDIMENT SAMPLE LOCATION
- ESTIMATED GROUNDWATER POTENTIOMETRIC SURFACE
- INFERED GROUNDWATER FLOW DIRECTION
- 15.68 GROUNDWATER POTENTIOMETRIC SURFACE ELEVATION (FEET ABOVE MEAN SEA LEVEL)
- ① FORMER HEATING OIL AND GASOLINE TANK LOCATION AND IDENTIFICATION
- FOOTPRINT OF FORMER INSTITUTE BUILDINGS
- SURFACE WATER DRAINAGE

NOTE:

DRAWING BASED ON CARSON DORN INC. APRIL 2003 AND WALSH PLANNING & DEVELOPMENT SERVICES MAY 2003.

100 0 50 100

SCALE: 1" = 100'

SLR Alaska

2525 Blueberry Road, Suite 206
Anchorage, AK 99503
(907)222-1112 Fax (907)222-1113

3522 International Street
Fairbanks, AK 99701
(907)455-9005 Fax (907)455-9015

CLIENT:

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

WRANGELL INSTITUTE SITE ASSESSMENT
WRANGELL, ALASKA
ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

GROUNDWATER POTENTIOMETRIC SURFACE

PROJECT MANAGER:	APPROVED:	DESIGNED:	SCALE:	REVISION:	FIGURE:
M. RIESER	R. KLIEFORTH	R. KLIEFORTH	1" = 100'	0	5
PROJECT NO.:	DRAWN:	DATE:	FILE:		
005.0065.03003	K. BOYESEN	JANUARY 2004	S:\Project\ADEC\Wrangell\Report		

TABLES

Table 1.
Fuel Storage Tanks Summary
Wrangell Institute

Tank Identification	Tank Location	Tank Description	Investigation Results	
			RA/TELLUS (December, 1999)	CDI (April, 2003)
1	Building 218, Pump House	400-gallon, No. 2 heating fuel, AST	Observed soil contamination. Removed 3 cubic yards (cy). Collected 3 samples. In-place soil determined to be below ADEC Method 2 cleanup levels. No recommendations.	No investigation.
2	Building 226, Gas Station	1,200-gallon, gasoline, UST (stand-alone)	No observed soil contamination. Collected 2 samples. GRO was not detected.	No investigation.
3	Building 204, North Staff Residence	600-gallon, No. 2 heating fuel, UST	Observed soil contamination. Removed 348 cy. Collected 3 samples. In-place soil determined to be below ADEC Method 2 cleanup levels. No recommendations.	No investigation.
4	Building 221, Carpenter Shop & Utility Building	275-gallon, No. 2 heating fuel, AST	Observed soil contamination. Removed 48 cy. Collected 3 samples. In-place soil determined to be below ADEC Method 2 cleanup levels. No recommendations.	No investigation.
5	Building 205, Duplex	600-gallon, No. 2 heating fuel, UST	Observed significant soil contamination. Collected 2 samples. Sample concentrations above ADEC Method 2 cleanup levels. No soil removal.	Observed significant soil and ground water contamination. Removed 700 cy. Collected 19 confirmation samples; 3 samples exceeded ADEC Method 2 cleanup levels. Recommended more investigation at the "triple junction", located east of building.
6	Building 211, Principal's Residence	600-gallon, No. 2 heating fuel, UST	Observed soil contamination. Removed 49 cy. Collected 3 samples. Sample concentrations above ADEC Method 2 cleanup levels. Recommended more investigation.	No investigation.
7	Building 201, Main School	600-gallon, No. 2 heating fuel, UST	Observed soil contamination. Removed 216 cy. Collected 2 samples. Sample concentrations above ADEC Method 2 cleanup levels. Recommended more investigation.	Observed soil and ground water contamination. Removed soil from 2-inch pipeline near Building 201. Recommended further investigation.
8	Building 210, Dining Hall	1,200-gallon, No. 2 heating fuel, UST	Observed significant soil contamination. Removed 43 cy. Collected 2 samples. Sample concentrations above ADEC Method 2 cleanup levels. Recommended more investigation.	Observed significant soil contamination. Removed 20 cy. Collected 1 sample; concentration exceeded the ADEC Method 2 DRO cleanup level. Recommended more investigation.

Table 1.
Fuel Storage Tanks Summary
Wrangell Institute

Tank Identification	Tank Location	Tank Description	Investigation Results	
			RA/TELLUS (December, 1999)	CDI (April, 2003)
9	Building 209, South Staff Residence	600-gallon, No. 2 heating fuel, UST	Observed soil contamination. Removed 42 cy. Collected 3 samples. Sample concentrations above ADEC Method 2 cleanup levels. Recommended more investigation.	Observed soil contamination. Removed 60 cy. Collected 2 samples. Samples below ADEC Method 2 cleanup levels. No specific recommendations.
10	Building 301, Hospital	600-gallon, No. 2 heating fuel, UST	Observed soil contamination. Collected 2 samples. Sample concentrations above ADEC Method 2 cleanup levels. No soil removal.	Observed soil contamination. Reported that impacted soil was result of pipeline - not UST. Recommended soil removal under roadbed.
11	Southeast Corner of Property	20,000-gallon, No. 2 heating fuel, AST	Removed tank. No investigation.	No investigation.
12	Southeast Corner of Property	20,000-gallon, No. 2 heating fuel, AST	Removed tank. No investigation.	No investigation.

Notes:
ADEC - Alaska Department of Environmental Conservation
AST - above-ground storage tank
cy - cubic yards
GRO - gasoline range organics
UST - underground storage tank

Table 2.
Soil Sample Observations, Screening, and Analytical Data
Wrangell Institute

Sample Location	Depth (feet bgs)	TPH, USEPA 9074 (ppm)	PID (ppm)	DRO, AK102 (mg/kg)	BTEX, USEPA 8021B (mg/kg)				PAHs, USEPA 8270C-SIM (mg/kg)									TOC, USEPA 9060 (mg/kg)	Observations
					Benzene	Toluene	Ethylbenzene	Xylynes (total)	Acenaphthene	Anthracene	Benzo(a)-anthracene	Benzo(a)-pyrene	Chrysene	Fluoranthene	Fluorene	Naphthalene	Pyrene		
ADEC Method 1 Cleanup Levels		NA	NA	100*	0.02	4.8	5	69	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
ADEC Method 2 Cleanup Levels		NA	NA	230	0.02	4.8	5	69	190	3,900	5.5	0.9	550	1,900	240	19	1,400	NA	
3-inch Supply Pipeline																			
PJ-1	1	645	13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Organic material at surface, silt at depth, strong hc odor 0'-1.5' bgs
PJ-10	0.5	201	38	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Silt 0'-2' bgs, gravel refusal at 2' bgs, hc odor 0'-1' bgs
PJ-11	1.5	--	13	**1,400**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Gravel at 1.5' bgs, slight hc odor
PJ-15	0.5	950	241	**32,000**	ND	0.097	0.098	1.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	Organic material, silt, sand, slight hc odor
PJ-15	2	170	89	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Cobble-gravel refusal, slight hc odor
PJ-15-N18	1.5	18	2.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Silt, sand, gravel, saturated, slight hc odor
PJ-15-N5	1.75	3,130	98	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Gravel refusal, saturated, strong hc odor
PJ-15-S5	1	74	7.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Silt and organic material, saturated, strong hc odor
PJ-16	1	11,410	129	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Silt, sand, gravel, moist, slight hc odor
PJ-17	1	1,047	33	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Silt and organic material, saturated, slight hc odor
PJ-2	1	--	0.8	71	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Organic material at surface, silt at depth, no hc odor
PJ-4	1.5	--	216	**5,600**	ND	0.18	0.049	1.7	ND	ND	ND	ND	ND	ND	ND	1.900	ND	--	Organic material at surface, silt and sand at depth, strong hc odor 0'-2' bgs
PJ-4-N14	1.5	--	2.9	69	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Sand with organic material, slight hc odor
PJ-4-N2	1	374	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Silt and organic material, strong hc odor
PJ-4-S5	1	--	2.2	**1,900**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Silt and organic material, moist, slight hc odor
PJ-6	0.5	--	100	**150,000**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Organic material, slight hc odor
PJ-6	1.5	303	23	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Organic material and minor sand, slight hc odor
MW-7	4	994	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SP, minor hc odor
MW-7	7	4,390	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SP, strong hc odor
20-000-Gallon AST																			
TP-HH	2	--	--	**5,000**	ND	0.014	ND	0.035	ND	ND	ND	ND	ND	ND	ND	ND	ND	--	GW, moderate organic material, saturated with sheen
TP-II	2	22	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GW, moderate organic material, no hc odor or staining
TP-JJ		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ML at 1' bgs
TP-OO	1	1,091	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GW, hc staining and odor
TP-OO	3	4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GW, underlain by ML
TP-PP	1	4,650	--	**4,800**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GW, hc odor and staining
TP-PP	1	--	--	**4,200**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GW, hc odor and staining (TP-DUP-4)
TP-PP	3	473	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM-ML, brown, no odor
Buildings 202, 301, and Institute Ave.																			
TP-BB	1.5	31	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM-GP, moist, no hc odor
TP-BB	4.5	578	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM-GP, moist, moderate hc odor
TP-BB1	1	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM-GP, moist, no hc staining or odor
TP-BB1	4.5	9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM-GP, moist, no hc staining or odor
TP-CC	1	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM-GP, moist, no hc staining or odor
TP-CC	6.5	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ML-SM, moist

Table 2.
Soil Sample Observations, Screening, and Analytical Data
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Sample Location	Depth (feet bgs)	TPH, USEPA 9074 (ppm)	PID (ppm)	DRO, AK102 (mg/kg)	BTEX, USEPA 8021B (mg/kg)				PAHs, USEPA 8270C-SIM (mg/kg)									TOC, USEPA 9060 (mg/kg)	Observations
					Benzene	Toluene	Ethylbenzene	Xylynes (total)	Acenaphthene	Anthracene	Benzo(a)-anthracene	Benzo(a)-pyrene	Chrysene	Fluoranthene	Fluorene	Naphthalene	Pyrene		
ADEC Method 1 Cleanup Levels		NA	NA	100*	0.02	4.8	5	69	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
ADEC Method 2 Cleanup Levels		NA	NA	230	0.02	4.8	5	69	190	3,900	5.5	0.9	550	1,900	240	19	1,400	NA	
TP-EE	3	--	--	**1,600**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, moderate organics, moist to wet, hc staining and odor
TP-EE	7	--	--	95	--	--	--	--	--	--	--	--	--	--	--	--	--	21,500	GM, moderate oragnics, moist to wet, minor hc staining and odor
TP-FF	3	536	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, black staining with minimum hc odor, saturated
TP-FF	6	--	--	**2,200**	ND	ND	0.026	0.046	0.280	ND	ND	0.090	ND	ND	1.4	1.2	ND	--	GM, black staining with strong hc odor, saturated
TP-FF	7	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ML
TP-GG	3	62	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, moist, no hc odor or staining
TP-KK	5.5	0	--	11	--	--	--	--	--	--	--	--	--	--	--	--	--	6,780	SM, moist, no hc staining or odor
TP-KK	5.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7,750	SM, moist, no hc staining or odor (TP-DUP-5)
TP-LL	5	6,740	--	**1,800**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, with black staining, moist
TP-LL	5	--	--	**2,200**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, with black staining, moist (TP-DUP-3)
TP-MM	0-4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Backfilled construction debris, saturated
TP-NN	1.5	148	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, dry-moist, no hc odor
TP-NN	4	381	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, dry-moist, no hc odor
TP-T	1	4,180	--	**2,000**	ND	ND	0.14	0.70	ND	ND	ND	ND	ND	ND	ND	ND	0.037	--	GM, strong hc odor, organic material
TP-T	3	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, with organic material, moderate hc odor
TP-U	2	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ML, blue-grey, no hc staining or odor
TP-V	4	13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM-SM, no hc odor
TP-X	3.5	2,560	--	**1,200**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SM grading to ML blue, hc odor
TP-X1	3	643	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, hc odor
TP-X1	7	8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	ML, no odor
TP-Y	3	--	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, with organic material, moist, no hc odor or staining
TP-Y	3	--	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, with organic material, moist, no hc odor or staining (TP-DUP-2)
Buildings 201, 203, and 210																			
TP-I	2.5	--	400	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, top of grey staining, strong hc odor
TP-I	8	--	--	**2,800**	0.0016	0.010	0.0076	0.15	0.150	ND	ND	ND	ND	ND	ND	ND	ND	--	GM, grey staining, hc odor, saturated with sheen
TP-I	8	--	--	**2,500**	ND	0.0070	0.0060	0.11	ND	ND	ND	ND	ND	ND	ND	0.300	ND	--	GM, grey staining, hc odor, saturated with sheen (TP-DUP-1)
TP-J	0-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Abundant underground pipelines 0' to 3' bgs
TP-K	3	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, moist, no hc staining, no odor
TP-K	10	--	0.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SP, grey natural color, no odor, saturated
TP-L	3	--	6.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, moderate hc staining and odor, abundant FeO
TP-L	5	--	131	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, moderate hc staining and odor, saturated
TP-M	3	--	1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM-SM, with FeO, no hc odor, dry
TP-M	7	--	1.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM-SM, with FeO, no hc odor, dry
TP-M	12	--	0.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM-SM, with FeO, no hc odor, trace water
TP-N	10.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM-SM, with FeO, no hc odor, trace water
TP-O2	3	32	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GP, within 5' of pipeline

Table 2.
Soil Sample Observations, Screening, and Analytical Data
Wrangell Institute

Sample Location	Depth (feet bgs)	TPH, USEPA 9074 (ppm)	PID (ppm)	DRO, AK102 (mg/kg)	BTEX, USEPA 8021B (mg/kg)				PAHs, USEPA 8270C-SIM (mg/kg)									TOC, USEPA 9060 (mg/kg)	Observations
					Benzene	Toluene	Ethylbenzene	Xylynes (total)	Acenaphthene	Anthracene	Benzo(a)-anthracene	Benzo(a)-pyrene	Chrysene	Fluoranthene	Fluorene	Naphthalene	Pyrene		
ADEC Method 1 Cleanup Levels		NA	NA	100*	0.02	4.8	5	69	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
ADEC Method 2 Cleanup Levels		NA	NA	230	0.02	4.8	5	69	190	3,900	5.5	0.9	550	1,900	240	19	1,400	NA	
TP-O3	6	OR	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GP with hc odor
TP-P	6	--	--	**6,300**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, FeO, strong hc staining and odor, water at 6.5' bgs
TP-Q	6	TE	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	6,500	GM, no organic material, moist, no staining
TP-Q	9.5	--	39	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, saturated
TP-QQ	3	278	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GW, black, minor construction debris, dry-moist
TP-QQ	8.5	150	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SP, fine-med grained, strong hc odor
TP-R	6	--	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	4,070	GM, no hc odor or staining
TP-R	9.5	--	--	**930**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, saturated, hc odor
TP-RR	7	--	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SP, fine-med grained, no hc staining or odor
TP-S	6	--	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, moist to wet, minor FeO, minor hc odor(?)
Intersection of Massin Ave. and Bay View Street																			
TP-D1	2	--	OR	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SP with organic material, abundant hc staining and odor
TP-D2	2	OR	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SP with organic material, abundant hc staining and odor
TP-D2	7	139	--	30	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SP, moderate hc staining and odor, water seeping in at 7 feet bgs
TP-D3	3	38	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SM, moist, moderate, discontinuous hc staining and odor
TP-E	3	--	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, abundant FeO and black (MnO?) staining, no hc staining or odor
TP-F	3	--	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, abundant FeO and black (MnO?) staining, no hc staining or odor
TP-G1	3	913	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, moist-wet, FeO, abundant hc staining and odor
TP-G1	6.5	--	--	**450**	0.0068	0.0065	0.022	0.057	ND	ND	ND	ND	ND	ND	ND	0.0043	ND	--	GM, moist-wet, FeO, abundant hc staining and odor
TP-G2	3	3	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, moist-wet, FeO, minor hc staining and odor
TP-G3	3	28	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SP with organic material, trace hc staining and odor
TP-H1	4	--	0.9	44	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GP, minor hc stain, saturated with slight sheen
TP-H2	4	--	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SM, dry to moist, no hc stain or odor
MW-3	3	--	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	5,590	GM, moderate organic materials, FeO layer with gray staining underneath
Building 205																			
TP-B	3	507	--	2.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GW, adjacent to concrete pad
TP-B	7	217	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GW, saturated (with sheen), underneath concrete pad
TP-C	3	32	--	11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GW, moist, FeO, no hc staining or odor
TP-C	11.5	34	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6-inch-thick SP, medium-grained, saturated
Building 211																			
TP-A	5	186	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, dry, FeO, no hc staining or odor
TP-A	9	686	1	230	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GP, moist, FeO, minor hc odor and stain
TP-A	10	2,158	148	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SP, medium-grained, saturated, hc staining and odor
Building 209																			
TP-DD	4	--	--	7.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	GM, with organic material, moist, no hc staining or odor
TP-DD	5	--	--	9.5	ND	0.024	ND	ND	ND	0.023	0.230	ND	0.190	0.250	0.0089	0.004	0.330	--	SM-ML, dry, discontinuous hc odor

Table 2.
Soil Sample Observations, Screening, and Analytical Data
Wrangell Institute

Sample Location	Depth (feet bgs)	TPH, USEPA 9074 (ppm)	PID (ppm)	DRO, AK102 (mg/kg)	BTEX, USEPA 8021B (mg/kg)				PAHs, USEPA 8270C-SIM (mg/kg)									TOC, USEPA 9060 (mg/kg)	Observations
					Benzene	Toluene	Ethylbenzene	Xylynes (total)	Acenaphthene	Anthracene	Benzo(a)-anthracene	Benzo(a)-pyrene	Chrysene	Fluoranthene	Fluorene	Naphthalene	Pyrene		
ADEC Method 1 Cleanup Levels		NA	NA	100*	0.02	4.8	5	69	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
ADEC Method 2 Cleanup Levels		NA	NA	230	0.02	4.8	5	69	190	3,900	5.5	0.9	550	1,900	240	19	1,400	NA	
Intersection of Zimovia Highway and Institute Ave.																			
TP-AA	5	--	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	SP, fine-medium grained, no hc odor or staining
TP-Z	5	--	--	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	4,400	SP, fine-medium grained, no hc odor or staining
Institute Creek																			
MW-8	8.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3,330	SP, coarse, well-rounded sand, no fines, minor pea gravel

Notes:
Results in bold exceed ADEC Method 2 cleanup levels
-- not analyzed
* Petroleum hydrocarbon soil cleanup levels in non arctic zones are calculated by parameters specified in the 18 AAC 75.340.
bgs - below ground surface
BTEX - benzene, toluene, ethylbenzene, and total xylenes
DRO - diesel range organics
FeO - iron oxide
GP - poorly-graded gravels (USCS classification)
GM - silty gravels (USCS classification)
GW - well-graded gravels (USCS classification)
hc - hydrocarbon
mg/kg - milligrams per kilogram
ML - inorganic silt (USCS classification)
NA - not applicable
ND - not detected
OR - TPH, USEPA 9074 (PetroFlag) sample over-range
PAH - polynuclear aromatic hydrocarbons; PAH compounds not detected are not included in the table
PID - photoionization detector
ppm - parts per million
SP - poorly-graded sands (USCS classification)
TE - TPH, USEPA 9074 (PetroFlag) temperature error

Table 3.
Ground and Surface Water Analytical Data
Wrangell Institute
(All units in mg/L)

Sample Locations	Sample Designation	Date Sampled	DRO, AK102	BTEX, USEPA 8021B				PAHs, USEPA 610 PAH									Total Aromatic Hydrocarbons	Total Aqueous Hydrocarbons
				Benzene	Toluene	Ethylbenzene	Xylenes (total)	Acenaphthene	Acenaphthylene	Anthracene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Fluorene	Indeno(1,2,3-cd)-pyrene	Naphthalene	Pyrene		
ADEC Surface and Ground Water Cleanup Levels (Table C, 18 AAC 75)			1.5	0.005	1.0	0.7	10.0	2.2	2.2	11.0	0.001	0.01	1.46	0.001	0.7	1.1	NA	NA
ADEC Water Quality Criteria (18 AAC 70)			NA	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.010	0.015
Ground Water																		
MW-1	MW-1	11/9/2003	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--
MW-2	MW-2	11/9/2003	0.3	ND	ND	ND	ND	ND	ND	ND	**0.0027**	0.0026	ND	**0.0026**	ND	ND	ND	0.0079
MW-2	MW-DUP-1	11/9/2003	0.33	ND	0.0011	ND	ND	ND	ND	ND	**0.0018**	0.0014	ND	**0.0017**	ND	ND	0.0011	0.006
MW-3	MW-3	11/9/2003	ND	ND	ND	ND	ND	ND	ND	ND	**0.0018**	ND	ND	ND	ND	ND	ND	0.0018
MW-4	MW-4	11/9/2003	**11**	ND	ND	0.0023	0.0041	0.011	0.0046	0.130	**0.0029**	0.0017	ND	**0.0014**	0.048	ND	0.0064	**0.206**
MW-5	MW-5	11/9/2003	**22**	ND	0.0014	ND	ND	ND	0.0068	ND	**0.0027**	0.0013	0.028	**0.0014**	ND	ND	0.0014	**0.0416**
MW-5	MW-DUP-2	11/9/2003	**28**	ND	0.001	ND	ND	--	--	--	--	--	--	--	--	--	0.001	0.001
MW-6	MW-6	11/9/2003	0.26	ND	0.0032	ND	0.0049	ND	ND	ND	**0.0026**	ND	ND	ND	ND	ND	0.0081	0.0107
MW-7	MW-7	11/11/2003	0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0019	ND	ND	0.0019
MW-8	MW-8	11/11/2003	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--
MW-9	MW-9	11/11/2003	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--
MW-10	MW-10	11/11/2003	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--
WW-1	WW-1	11/9/2003	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--
WW-2	WW-2	11/9/2003	ND	ND	ND	ND	ND	--	--	--	--	--	--	--	--	--	--	--
Surface Water																		
SW-1	SW-1	11/5/2003	--	ND	ND	ND	ND	ND	ND	ND	**0.0014**	ND	ND	ND	0.0012	ND	ND	0.0026
SW-2	SW-2	11/5/2003	--	ND	ND	ND	ND	ND	ND	0.0040	ND	ND	ND	ND	0.0013	ND	ND	0.0053
SW-2	SW-DUP-1	11/5/2003	--	ND	0.0018	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0020	ND	0.0018	0.0038
SW-3	SW-3	11/5/2003	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW-4	SW-4	11/5/2003	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW-5	SW-5	11/5/2003	--	ND	ND	ND	ND	ND	ND	ND	**0.0095**	ND	ND	ND	ND	ND	ND	0.0095
SW-6	SW-6	11/5/2003	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW-6	SW-DUP-2	11/5/2003	--	ND	0.0020	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002	0.002
SW-7	SW-7	11/5/2003	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW-8	SW-8	11/5/2003	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW-9	SW-9	11/11/2003	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SW-10	SW-10	11/11/2003	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
Results in bold exceed ADEC cleanup levels
-- not analyzed
BTEX - benzene, toluene, ethylbenzene, and xylenes
DRO - diesel range organics
mg/L - milligrams per liter
NA - not applicable
ND - not detected at or above method reporting limit
PAH - polynuclear aromatic hydrocarbons; PAH compounds not detected are not included in the table
Total aromatic hydrocarbons - the sum of all BTEX compounds
Total aqueous hydrocarbons - the sum of all BTEX and PAH compounds

Table 4.
Sediment Sample Observations and Anayltical Data
Wrangell Institute
(All units in mg/kg, dry weight basis)

Sample Location		DRO AK102	BTEX, USEPA 8021B				PAHs, USEPA 8270C-SIM								Observations
			Benzene	Toluene	Ethylbenzene	Xylynes (total)	2-Methyl-naphthalene	Benzo(a)-anthracene	Chrysene	Fluoranthene	Fluorene	Naphthalene	Pyrene	Total PAH	
ADEC Method 1 Cleanup Levels		100*	0.02	4.8	5	69	NA	NA	NA	NA	NA	NA	NA	--	
ADEC Method 2 Cleanup Levels		230	0.02	4.8	5	69	54.5	5.5	550	1,900	240	19	1,400	--	
NOAA ERL		--	--	--	--	--	0.070	0.261	0.384	0.6	0.019	0.160	0.665	4.022	
NOAA ERM		--	--	--	--	--	0.670	1.6	2.8	5.1	0.540	2.1	2.6	44.792	
SED-1		66	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0042	ND	0.0042	FeO-stained seep along Institute Avenue
SED-2		120	ND	ND	ND	ND	ND	ND	ND	ND	0.046	ND	ND	0.046	FeO-stained seep between the fence line and the Zimovia Highway
SED-2	(DUP)	110	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	FeO-stained seep between the fence line and the Zimovia Highway
SED-3		6.8	ND	ND	ND	ND	ND	0.0062	0.0076	0.020	ND	ND	ND	0.0338	culvert draining into Institute Creek, orange algae observed
SED-4		**31,000**	ND	ND	ND	ND	**9.5**	ND	ND	ND	ND	1.6	ND	**11.1**	Natural outlet draining former south staff residence, sheen observed
SED-5		**840**	ND	ND	ND	0.10	ND	ND	ND	ND	ND	0.011	ND	0.011	Low-flow drainage between the fence line and the Zimovia Highway
SED-6		41	ND	ND	ND	ND	ND	ND	ND	0.0088	ND	ND	0.016	0.0248	Culvert draining into Institute Creek
SED-7		**19,000**	ND	0.037	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Near the 3-inch supply pipeline, sheen observed
SED-8		ND	ND	0.011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Between the fenceline and the Zimovia Highway
SED-9		ND	ND	0.011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Institute Creek outlet (to Prince William Sound), near MW-8
SED-10		**300**	ND	0.011	ND	ND	ND	ND	ND	ND	ND	0.0076	ND	0.0076	Drainage north of Zimovia Highway and south of the Institute

Notes:
Results in bold exceed ADEC Method 2 cleanup levels
Results in underlined bold exceed NOAA ERL and/or ERM levels
* Petroleum hydrocarbon soil cleanup levels in non arctic zones are calculated by parameters specified in the 18 AAC 75.340.
BTEX - benzene, toluene, ethylbenzene, and total xylenes
DRO - diesel range organics
DUP - duplicate
ERL - effects range-low
ERM - effects range-median
FeO - iron oxide
mg/kg - milligrams per kilogram
NA - not applicable
ND - not detected
NOAA - National Oceanic and Atmospheric Administration
PAH - polynuclear aromatic hydrocarbons; PAH compounds not detected are not included in the table
SIM - selected ion monitoring

Table 5.
Stockpile Sample Observations and Analytical Data
Wrangell Institute
(All units in mg/kg)

Sample Location	Depth (feet bgs)	DRO, AK102	BTEX, USEPA 8021B				Observations
			Benzene	Toluene	Ethylbenzene	Xylynes (total)	
ADEC Method 1 Cleanup Levels		100*	NA	NA	NA	NA	
ADEC Method 2 Cleanup Levels		230	0.02	4.8	5	69	
SP-1	1-2	**1,200**	ND	ND	ND	ND	GW, moist, no staining, strong hydrocarbon odor
SP-2	2-3	**1,200**	ND	0.019	ND	ND	GW, moist, no staining, strong hydrocarbon odor
SP-2 (DUP)	2-3	**1,100**	ND	0.010	ND	0.023	GW, moist, no staining, strong hydrocarbon odor
SP-3	1.5-2	**1,100**	ND	0.011	ND	0.036	GW, moist, no staining, strong hydrocarbon odor
SP-4	1-1.5	**1,100**	ND	ND	ND	0.023	GW, moist, no staining, strong hydrocarbon odor

Notes:
Results in bold exceed ADEC Method 2 cleanup levels
* Petroleum hydrocarbon soil cleanup levels in non arctic zones are calculated by parameters specified in the 18 AAC 75.340.
bgs - below ground surface
BTEX - benzene, toluene, ethylbenzene, and total xylenes
DRO - diesel range organics
mg/kg - milligrams per kilogram
ND - not detected

Table 6.
Soil Treatment Options - Summary
Wrangell Institute

Criteria	On-Site or Local Treatment					Off-Site Treatment
	Thermal Treatment		Biological Treatment		Encapsulation	
	Hot Air Vapor Extraction	Soil Burner	Biological Treatment Cell	Landfarming	Roadbed Encapsulation	Disposal at a Licensed Landfill or Treatment Facility
Overall protection of human health and the environment	5	5	4	3	5	5
Compliance with applicable, relevant, appropriate requirements	5	5	4	3	5	5
Long-term effectiveness and permanence	5	5	3	3	4	5
Reduction of toxicity, mobility, or volume	5	5	3	3	4	5
Short-term effectiveness	5	5	2	2	5	5
Implementability	4	4	4	3	1	5
Cost	2	2	2	1	5	3
Anticipated State and Community Acceptance	3	3	3	2	3	3
Score:	**34**	**34**	**25**	**20**	**32**	**36**

Notes:
1. Poor applicability
2. Moderate applicability
3. Average applicability
4. Good applicability
5. Excellent applicability

APPENDIX B

PHOTOGRAPHIC LOG

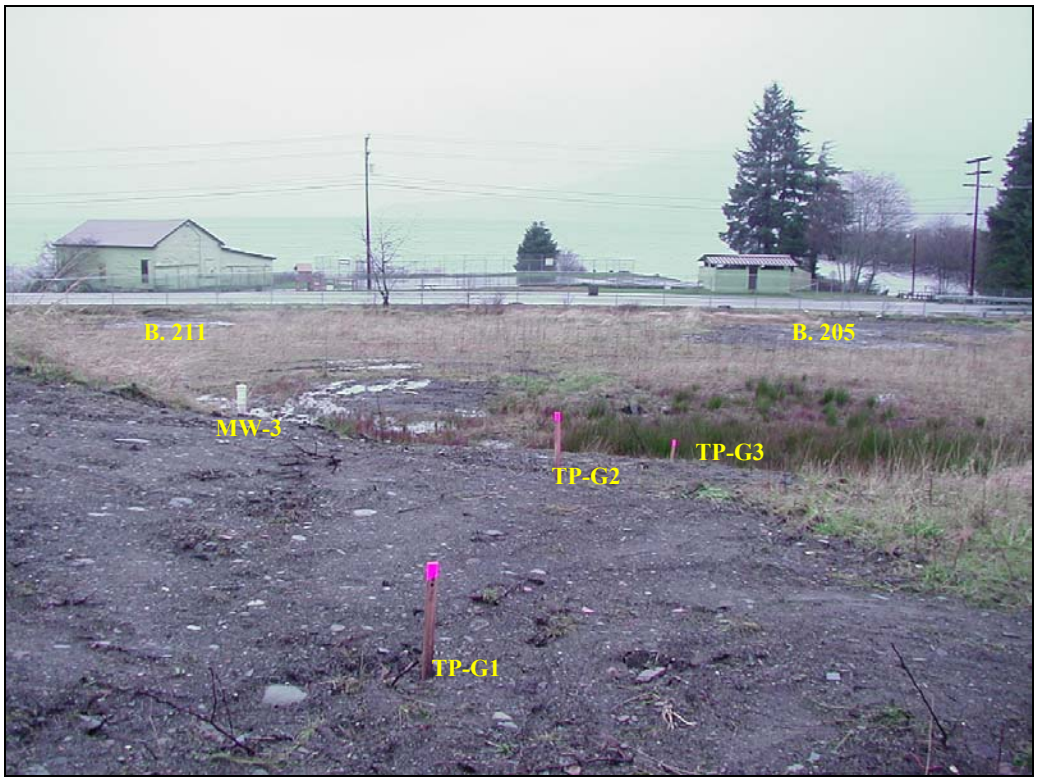

Photo 1. Looking northwest from the corner of Massin Avenue and Bay View Street. TP-G and MW-3 are in the foreground and the former locations of Buildings 211 and 205 are in the background. In 2001, approximately 700 cubic yards of hydrocarbon-impacted soil were removed between Building 205 and TP-G3 (CDI, 2003).

Photo 2. Concrete pad at test pit TP-B, the former location of the duplex. PetroFlag® soil samples were collected adjacent to the pad and below the pad. Results were 507 and 217 ppm, respectively.

Photo 3. Looking north from the corner of Massin Avenue and Bay View Street. TP-D is being excavated; TP-H is to viewer's right and TP-G is to the left.

Photo 4. TP-L is located downgradient of the former Building 210. A PID screening sample of the iron-oxide stained soil at 3 feet bgs measured 6.8 ppm. At 5 feet bgs, groundwater was encountered. Hydrocarbon staining was observed in the saturated soil; a PID screening sample measured 131 ppm.

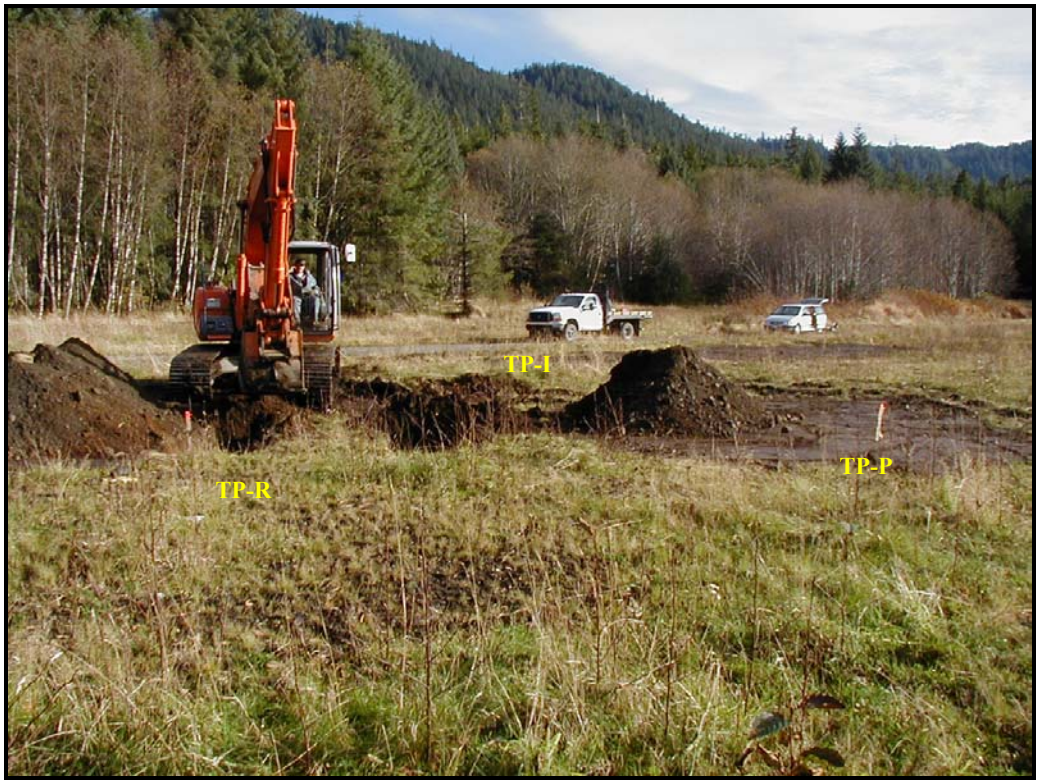

Photo 5. Looking east-southeast at the Building 210 soil plume. Laboratory analytical sample TP-R-6 had nondetectable DRO and sample TP-P-6 had 6,300 mg/kg DRO. Hydrocarbon staining and odor was observed in the trench between test pits TP-P and TP-R.

Photo 6. Opposite view from Photo 5 of Building 210 soil plume area. Taken from Bay View Street, viewing northwest. Monitoring well MW-4 was later constructed between TP-I and TP-P. Ground water samples from both MW-4 and MW-5 exceeded ADEC water cleanup levels (Table C, 18 AAC 75) and water quality criteria (18 AAC 70).

Photo 7. Viewing northwest, with Institute Drive in the foreground. Sample TP-X-3.5 contained DRO at a concentration of 1,200 mg/kg.

Photo 8. Viewing southeast, with Institute Drive in the foreground. Test pits TP-BB, TP-BB1, and TP-CC delineated the soil plume in the southern direction.

Photo 9. TP-DD, located at Building 209 (South Staff Residence), contained hydrocarbon concentrations below ADEC Method 2 cleanup levels. The former location of the two primary 20,000-gallon ASTs is barely visible in the background, almost visible.

Photo 10. TP-HH is located at two primary 20,000-gallon ASTs. A sample collected from the stained zone at 2 feet bgs contained 5,000 mg/kg DRO.

Photo 11. Looking north, towards the former location of the two 20,000-gallon ASTs as viewed from sample location PJ-1 (on the 3-inch supply pipeline).

Photo 12. Three-inch supply pipeline at sample location PJ-4. The hand auger is placed at T-junction to 2-inch supply pipeline.

Photo 13. CDI stockpile, located approximately ¼ mile north of the Institute.

APPENDIX C

TEST PIT AND MONITORING WELL LITHOLOGY AND SELECT ANALYTICAL DATA

Appendix C
Test Pit and Monitoring Well Lithology and Select Analytical Data
Wrangell Institute

Sample Location	Depth (feet bgs)	TPH, USEPA 9074 (ppm)	PID (ppm)	DRO, AK102 (mg/kg)	Observations
TP-A	0-3	--	--	--	GM, black, dry, rounded-subangular, no hc staining or odor
	3-6	--	--	--	GM, less organics, dry, sewer pipe, 2-3-ft-wide FeO zone, no hc staining or odor
	5	186	--	--	GM, dry, FeO, no hc staining or odor
	6-9	--	--	--	GP, moist, discontinuous FeO, minor hc odor and stain
	9	686	1	230	GP, moist, FeO, minor hc odor and stain
	10	2,158	148	--	SP, medium-grained, saturated, hc staining and odor
TP-B	0-3	--	--	--	GW with moderate to high organic content, 2.2-ft-thick concrete pad at 3 ft bgs
	3	507	--	2.2	GW, adjacent to concrete pad, two 1-inch-thick lines (flexible and steel)
	3-7	--	--	--	GW, black, rounded, saturated, one 5-inch pipe, one 1-inch pipe
	7	217	--	--	GW, saturated (with sheen), underneath concrete pad
TP-C	0-2	--	--	--	soil with high organic content, black, dry
	2-7	--	--	--	GW, with 10-inch corregated steel pipeline, black (MnO?) and FeO staining
	3	32	--	11	GW, moist, FeO, no hc staining or odor
	7-13	--	--	--	GW, moist-wet, FeO, no hc staining or odor
	11.5	34	--	--	6-inch-thick SP, medium-grained, saturated
TP-D1	0-2	--	--	--	SP with organic material, abundant hc staining and odor
TP-D2	0-2	OR	--	--	SP with organic material, abundant hc staining and odor
	2-7	--	--	--	SP, moderate hc staining and odor, water seeping in at 7 feet bgs
	7	139	--	30	SP, moderate hc staining and odor, water seeping in at 7 feet bgs
TP-D3	0-3	--	--	--	SM, moist, moderate, discontinuous hc staining and odor
	3	38	--	ND	SM, moist, moderate, discontinuous hc staining and odor
TP-E	0-0.5	--	--	--	Soil with high organic content, black, saturated at surface, 6-inch steel pipe
	0.5-4.5	--	--	--	GM, abundant Feo and black (MnO?) staining, no obvious hc staining or odor
	3	--	0	--	GM, abundant Feo and black (MnO?) staining, no obvious hc staining or odor
TP-F	0-0.5	--	--	--	Soil with high organic content, black, saturated at surface, 6-inch steel pipe
	0.5-4.5	--	--	--	GM, abundant FeO and black (MnO?) staining, no hc staining or odor
	3	--	0	--	GM, abundant FeO and black (MnO?) staining, no hc staining or odor
TP-G1	0-6.5	--	--	--	GM, moist-wet, FeO, abundant hc staining and odor, 6-inch steel pipe
	3	913	--	--	GM, moist-wet, FeO, abundant hc staining and odor
	6.5	--	--	**450**	GM, moist-wet, FeO, abundant hc staining and odor

Appendix C
Test Pit and Monitoring Well Lithology and Select Analytical Data
Wrangell Institute

Sample Location	Depth (feet bgs)	TPH, USEPA 9074 (ppm)	PID (ppm)	DRO, AK102 (mg/kg)	Observations
TP-G2	0-3	--	--	--	GM, moist-wet, FeO, minor hc staining and odor, abundant 2-inch steel pipe
	3	3	--	ND	GM, moist-wet, FeO, minor hc staining and odor
TP-G3	0-3	--	--	--	SP with organic material, trace hc staining and odor
	3	28	--	--	SP with organic material, trace hc staining and odor
TP-H	0-4	--	--	--	GP with SM lens at 2-4 feet bgs at eastern end of trench (TP-H2)
TP-H1	4	--	0.9	44	GP, minor hc stain, saturated with slight sheen
TP-H2	4	--	0	--	SM, dry to moist, no hc stain or odor
TP-I	0-2	--	--	--	Soil with high organic content, black, two 6-inch sewer(?) pipes
	2-8	--	--	--	GM, grey staining, strong hc odor, saturated with sheen at 8 feet bgs
	2.5	--	--	--	GM, top of grey staining, strong hc odor
	8	--	--	**2,800**	GM, grey staining, hc odor, saturated with sheen
TP-J	0-3	--	--	--	Abundant underground pipelines 0' to 3' bgs
TP-K	0-1	--	--	--	Soil with high organic content, black, moist
	1-9.5	--	--	--	GM, moist, no hc staining, no odor
	3	--	1	--	GM, moist, no hc staining, no odor
	10	--	0.3	--	SP, grey (natural color), no odor, saturated
TP-L	0-1	--	--	--	Soil with high organic content, black, moist
	1-5	--	--	--	GM, moderate hc staining and odor, abundant FeO
	3	--	6.8	--	GM, moderate hc staining and odor, abundant FeO
	5	--	131	--	GM, moderate hc staining and odor, saturated
TP-M	0-0.5	--	--	--	Soil with high organic content, black, dry
	0.5-12	--	--	--	GM-SM, with FeO, no hc odor, dry
	3	--	1.0	--	GM-SM, with FeO, no hc odor, dry
	7	--	1.0	--	GM-SM, with FeO, no hc odor, dry
	12	--	0.3	--	GM-SM, with FeO, no hc odor, trace water
TP-N	0-0.5	--	--	--	Soil with high organic content, black, dry
	0.5-10.5				GM-SM, with FeO, no hc odor, dry
	10.5	--	--	--	GM-SM, with FeO, no hc odor, trace water
TP-O1	0-0.5	--	--	--	Soil with high organic content, black, dry
	1-4.5	--	--	--	GM-GP 1'-4.5' bgs, no hc staining or odor

Appendix C
Test Pit and Monitoring Well Lithology and Select Analytical Data
Wrangell Institute

Sample Location	Depth (feet bgs)	TPH, USEPA 9074 (ppm)	PID (ppm)	DRO, AK102 (mg/kg)	Observations
TP-O1	4.5-5.5	--	--	--	SP 4.5'-5.5' bgs, no hc staining or odor
TP-O2	3	32	--	--	GP, within 5' of pipeline
TP-O3	6	OR	--	--	GP with hc odor
TP-P	0-3	--	--	--	GM with FeO, no hc stain or odor, dry-moist
	3-6	--	--	--	GM, strong hc staining and odor, FeO, moist
	6	--	--	**6,300**	GM, FeO, strong hc staining and odor, water at 6.5' bgs
TP-Q	0-0.5	--	--	--	Soil with high organic content, black, dry
	0.5-9.5	--	--	--	GM, no organic material, moist, no staining
	6	TE	--	ND	GM, no organic material, moist, no staining
	9.5	--	39	--	GM, saturated
TP-R	0-9	--	--	--	GM, no hc odor or staining
	6	--	--	ND	GM, no hc odor or staining
	9.5	--	--	**930**	GM, saturated, hc odor
TP-S	0-0.5	--	--	--	Soil with high organic content, black, dry
	0.5-6	--	--	--	GM, minor FeO, moist, no hc staining
	6	--	--	--	GM, moist to wet, minor FeO, minor hc odor(?)
	6-8	--	--	--	GM, moist to wet, minor FeO, minor hc odor(?)
TP-T	0-3.5	--	--	--	GM, with organic material, moderate to strong hc odor
	1	4,180	--	**2,000**	GM, with organic material, strong hc odor
	3	6	--	--	GM, with organic material, moderate hc odor
	4	--	--	--	ML, blue-grey, no hc staining or odor
TP-U	0-2	--	--	--	Soil with high organic content, black, moist
	2	1	--	--	ML, blue-grey, no hc staining or odor
TP-V	0-4	--	--	--	GM-SM, moist, no hc staining or odor
	4	13	--	--	GM-SM, moist, no hc staining or odor
	4-6	--	--	--	SM, moist-wet, saturated at 5-6 feet bgs, no hc staining or odor
	6-7	--	--	--	SM grading to blue-grey ML
TP-X	0-2	--	--	--	GM with organic material
	2-4	--	--	--	SM grading to ML blue-grey, hc odor
	3.5	2,560	--	**1,200**	SM grading to ML blue-grey, hc odor

Appendix C
Test Pit and Monitoring Well Lithology and Select Analytical Data
Wrangell Institute

Sample Location	Depth (feet bgs)	TPH, USEPA 9074 (ppm)	PID (ppm)	DRO, AK102 (mg/kg)	Observations
TP-X1	2-7	--	--	--	GM, moist, hc odor
	3	643	--	--	GM, moist, hc odor
	7	8	--	--	ML, no odor
TP-Y	0-5	--	--	--	GM, with organic material, moist, no hc odor or staining
	3	--	--	ND	GM, with organic material, moist, no hc odor or staining
	5-6	--	--	--	SM, grey, moist, no hc staining or odor
	6	--	--	--	SM transitions to black clay/silt
TP-Z	0-4	--	--	--	GM with organic material, moist, no hc staining or odor
	4-5.5	--	--	--	SP-SM-GM lenses, fine-medium grained sand, no hc odor or staining
	5	--	--	ND	SP, fine-medium grained, no hc odor or staining
	5.5-6.5	--	--	--	SP, fine-medium grained, no hc odor or staining
TP-AA	0-2	--	--	--	Soil with organic material, dry to moist, no hc staining or odor
	2-6	--	--	--	SP, fine-medium grained, no hc odor or staining
	5	--	--	ND	SP, fine-medium grained, no hc odor or staining
TP-BB	0-1.5	--	--	--	Soil with organic material and roots, dry, no hc staining or odor
	1.5	31	--	--	GM-GP, moist, no hc odor
	1.5-2.5	--	--	--	GM-GP, moist, no hc odor
	2.5-4.5	--	--	--	GM-GP, moist, moderate hc odor
	4.5	578	--	--	GM-GP, moist, moderate hc odor
	5	--	--	--	ML, blue-grey, no hc staining or odor
TP-BB1	0-1	--	--	--	Soil with organic material and roots, dry, no hc staining or odor
	1-5	--	--	--	GM-GP, moist, no hc staining or odor
	1	10	--	--	GM-GP, moist, no hc staining or odor
	4.5	9	--	--	GM-GP, moist, no hc staining or odor
	5	--	--	--	ML, blue-grey, no hc staining or odor
TP-CC	0-4.5	--	--	--	GM-GP, moist, no hc staining or odor
	1	15	--	--	GM-GP, moist, no hc staining or odor
	4.5-7	--	--	--	ML-SM, moist, no hc staining or odor
	6.5	6	--	--	ML-SM, moist, no hc staining or odor
TP-DD	0-4.5	--	--	--	GM, with organic material, moist, no hc staining or odor

Appendix C
Test Pit and Monitoring Well Lithology and Select Analytical Data
Wrangell Institute

Sample Location	Depth (feet bgs)	TPH, USEPA 9074 (ppm)	PID (ppm)	DRO, AK102 (mg/kg)	Observations
TP-DD	4	--	--	7.0	GM, with organic material, moist, no hc staining or odor
	5	--	--	9.5	SM-ML, dry, discontinuous hc odor
TP-EE	0-3	--	--	--	GM, moderate organics, moist, no hc staining and odor, two 1-inch fuel lines
	3	--	--	**1,600**	GM, moderate organics, moist to wet, hc staining and odor
	3-7	--	--	--	GM, moderate organics, moist to wet, hc staining and odor
	7	--	--	95	GM, moderate organics, moist to wet, minor hc staining and odor
	7.5	--	--	--	ML, dry, no hc staining or odor
TP-FF	0-2	--	--	--	GM, saturated, 1-inch fuel line at 2 feet bgs
	2-6	--	--	--	GM, black staining with hc odor, saturated
	3	536	--	--	GM, black staining with minimum hc odor, saturated
	6	--	--	**2,200**	GM, black staining with strong hc odor, saturated
	7	0	--	--	ML
TP-GG	0-5	--	--	--	GM, moist, no hc odor or staining
	3	62	--	--	GM, moist, no hc odor or staining
TP-HH	0-3	--	--	--	GW, moderate organic material, saturated with sheen
	2	--	--	**5,000**	GW, moderate organic material, saturated with sheen
	3	--	--	--	ML, blue-grey, dry, no hc staining or odor
TP-II	0-2	--	--	--	GW, moderate organic material, no hc odor or staining
	2	22	--	--	GW, moderate organic material, no hc odor or staining
	3	--	--	--	ML, blue-grey, dry, no hc staining or odor
TP-JJ		--	--	--	ML at 1' bgs
TP-KK	0-5.5	--	--	--	GM, moist, no hc staining or odor
	5.5	0	--	11	SM, moist, no hc staining or odor
	6	--	--	--	ML, blue-grey, dry, no hc staining or odor
TP-LL	0-5	--	--	--	GM, with black staining, moist
	5	6,740	--	**1,800**	GM, with black staining, moist
TP-MM	0-4	--	--	--	Backfilled construction debris, saturated
TP-NN	0-4	--	--	--	GM, dry-moist, no hc odor
	1.5	148	--	--	GM, dry-moist, no hc odor
	4	381	--	--	GM, dry-moist, no hc odor

Appendix C
Test Pit and Monitoring Well Lithology and Select Analytical Data
Wrangell Institute

Sample Location	Depth (feet bgs)	TPH, USEPA 9074 (ppm)	PID (ppm)	DRO, AK102 (mg/kg)	Observations
TP-NN	4.5	--	--	--	ML, blue-grey, dry, no hc staining or odor
TP-OO	0-2.5	--	--	--	GW, hc staining and odor
	1	1,091	--	--	GW, hc staining and odor
	3	4	--	--	GW, underlain by ML
TP-PP	0-1.5	--	--	--	GW, hc odor and staining
	1	4,650	--	**4,800**	GW, hc odor and staining
	1.5-5.5	--	--	--	GM-ML, brown, no odor
	3	473	--	--	GM-ML, brown, no odor
	5.5	--	--	--	ML, blue-grey, dry, no hc staining or odor
TP-QQ	0-6	--	--	--	GW, black, minor construction debris, dry-moist
	3	278	--	--	GW, black, minor construction debris, dry-moist
	6-13	--	--	--	SP, grey, natural color(?), moist, minor/inconsistant hc odor
	8.5	150	--	--	SP, fine-med grained, strong hc odor
TP-RR	0-7	--	--	--	SP, fine-med grained, no hc staining or odor
	7	--	0	--	SP, fine-med grained, no hc staining or odor
MW-1	0-5	--	--	--	GW, black, dry, no hc staining or odor
	5-7	--	--	--	GW, black, moist, no hc staining or odor
	7-10.5	--	--	--	GW, black, saturated, no hc staining or odor
MW-2	0-9.5	--	--	--	GM, moist, moderate silt and organic content, strong organic odor
	9.5-13	--	--	--	GM, saturated with sheen, strong organic odor
MW-3	0-3	--	--	--	GM, moderate organic materials, moist
	3	--	--	ND	GM, moderate organic materials, FeO layer with gray staining underneath, moist
	3.5-6.5				GM, moderate organic materials, saturated
MW-4	0-2	--	--	--	GM, highly organic, moderate-discontinuous hc staining and odor
	2-8.5	--	--	--	GW, moist, pervasive hc staining and odor
	8.5-12	--	--	--	GW, saturated, pervasive hc staining and odor
MW-5	0-9.5	--	--	--	GW, no organic materials, dry, 6-inch thick FeO zone at 5 feet bgs
	9.5-13	--	--	--	GW, no organic materials, saturated, water coming in fast
MW-6	0-7	--	--	--	GM, moist, no hc staining or odor
	7-8.5	--	--	--	GM, saturated with sheen

Appendix C
Test Pit and Monitoring Well Lithology and Select Analytical Data
Wrangell Institute

Sample Location	Depth (feet bgs)	TPH, USEPA 9074 (ppm)	PID (ppm)	DRO, AK102 (mg/kg)	Observations
MW-7	0-4	--	--	--	GW, black, dry, minor road fill material
	4-8	--	--	--	SP, minor-strong hc odor
	4	994	--	--	SP, minor hc odor
	7	4,390	--	--	SP, strong hc odor
MW-8	0-8.5	--	--	--	GW, black, dry-moist, no hc staining or odor
	8.5-10.5	--	--	--	SP, coarse, well-rounded sand, no fines, minor pea gravel, no hc staining or odor
MW-9	0-3	--	--	--	GM, red, abundant organic matertial, no hc staining or odor
	3-9	--	--	--	SP, fine-medium grained, grey, moist, no hc odor or staining
ADEC Method 1 Cleanup Levels		NA	NA	100*	
ADEC Method 2 Cleanup Levels		NA	NA	230	

Notes:
Bold numbers exceed ADEC Method 2 DRO soil cleanup level
-- not analyzed
* Petroleum hydrocarbon soil cleanup levels in non arctic zones are calculated by parameters specified in the 18 AAC 75.340.
bgs - below ground surface
DRO - diesel range organics
FeO - iron-oxide staining zone
hc - hydrocarbon
mg/kg - milligrams per kilogram
NA - not applicable
ND - not detected
OR - TPH, USEPA 9074 (PetroFlag) sample over-range
PID - photoionization detector
ppm - parts per million
TE - TPH, USEPA 9074 (PetroFlag) temperature error

APPENDIX D

FIELD NOTES

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CONTENTS

PAGE	REFERENCE	DATE

2

29 Oct 2003 — Mike Riesop, Robert Kliebenstein — Weather - sunny, clear ≈ 45°F

1600 - Anne Wrangell, pick-up rental car, go to City Hall to check-in with Valorie (Mayor), Bob Prunella (City Manager), and Bob Caldwell (Department of Public Works). Bob Caldwell will be our contact.

1700 - Go to site, check that key from Bob Caldwell will work (Master Key 10L320).

1745 - Check-in to Hastings Lodge, go over workplan and objectives for Thursday

Done for the day

1/2

30 Oct 2003 — Mike Riesop, Robert Kliebenstein — AM - cool, ≈ 25°F, sunny, calm; PM - ≈ 40°F

0730 - Drop in to see Bob Caldwell, Bob provides As-built for water line, says sewer line is between gravel and power pole line.

0900 ARRIVE AT SITE. WALK SOUTHERN PERIMETER. SUPPLY PIPE IS ABOVE-GROUND, AND ALONG WETLAND DELINEATION.
=> CONSEQUENTLY, SOIL INVESTIGATION WILL MOST LIKELY BE HAND AUGER & SURFACE SAMPLES ... NOT BACKHOE

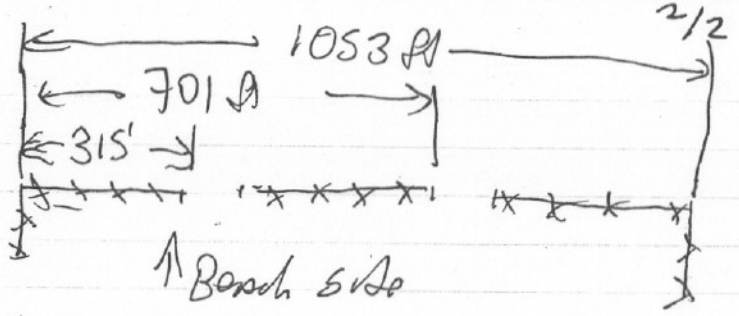
1100 MIKE USES MAGNETIC LOCATOR TO TRACE SUPPLY PIPE (WHICH HAS OFFSET NEAR TANKS)
BOB BEGINS GPS-ING SITE FEATURE

1200 LUNCH. PICK UP SUPPLIES @ LYNDEN AIR CARGO. WELL SUPPLIES WILL BE LATE - TUESDAY.

1330 CONTINUE WALKING SITE & SURVEYING
CDI FIGURE HAS SUSPECT SCALE.

NOTES: 1) ELM TREE BLIME IS STEEP
2) NE NW SIDE MASSIN IS STEEP
3) NORTHERN WATER WELL IS RIC- CAPPED. SOUTHERN IS ~3" PIPE W/ HEAVY SHEEN.
4) 2 x 20000 ABOVE GROUND TANK AREA HAS EXTRA PIPE & CONCRETE DEBRIS

30 Oct 2003



5) DRUMS LOCATED IN NE 1/5 BORDER/FELKE AREA

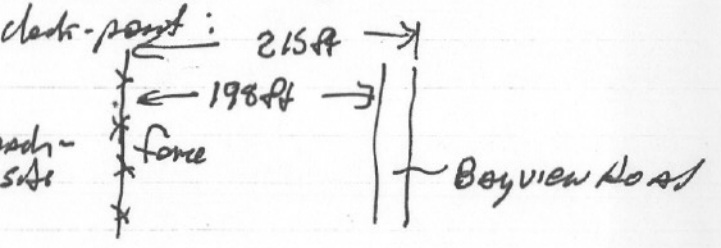
6) HEAVY Fe-STAIN @ SE CORNER OF GIRLS DORM, NEAR TAG

- Drainage above institute area is diverted to the north (Institute creek) and channelized past the old garage area, limited drainage goes down some area as old fuel line.
- Water well house has piping in ground, possibly connected water well. Sheen is present on surface water beside the pipe.
- Map dimensions do not correspond to site conditions, I phone Bob Caldwell to see if an air photo taken prior to building demolition is available.

1730 Break for Dinner
1830 - 2100 - Update PC software to download Easton Dorm data file to GPS, review reference points for test pits near known soil contamination. Done for the day.

10/31/03

0700 on site, start to lay-out area from old GPS file.



- Updated overlay corresponds well to site, we lay-out Dining Hall, Main School Bldg, Girls Dorm, Boys Dorm, Hospital, south teachers dorm, Duplex, Principals residence, carpenters shop.
- Place test pit locations. Some relocation is necessary as the real-world dimensions are not the same as the Report Figure. Bob and I go to Public works office + meet with Bob Caldwell, ask about excavating in parts area. Bob C. gives us an OK., we will try to minimize footprint. Bob has not located an air photo. I borrow the 1999 Tellus report documenting the tank pull and early cleanup actions.

10/31/2003

Bob gives us name of person preparing electronic maps of city property, Greg Schaff, p. 874-2711.

1545 - Picks-up Kristen at airport, picks up peristaltic pump from Alaska Air Cargo.

- Return to site, give Kristen site orientation, set up for test pitting in morning

1700 - Back at Lodge. Bob calls Bret Westberry to confirm meet in the morning. Bret has just dropped off backhoe at site.

1830 - review petroflag manual and calibration to site soil.

1900 - Done for the day

Mb Rh

11/1/03

Kristen Bergeson
Mike Kiesser
Bob Kliefoth

- 0630 - depart Lodge, meet Bret Westberry at site, fill in ditch on south approach to get vehicle access

- Set-up and begin excavating TP-A at former Principals residence. Set-up and calibrate Petro Flag kit.

- Analyze sample TP-A-9, PetroFlag response factor = 7 (#2 fuel oil)

Sample	PetroFlag
Cal	1000
TP-A-9'	686

0930 - I go and mark sample locations on the fuel line on the south side of the property. The pipe lengths are 21 ft, 3" ID steel line, with threaded collar connections.

- The former AST fuel tank area has broken concrete rubble and scrap fuel line, including steel and rubber line, present. A 20-ft diameter area remains with no vegetation. Soil in this area has a very strong diesel odor and is gray-stained.

1 Nov 2003

10:45 - Began hand-augering soil samples from pipe joint locations:

PJ-1 - surface material is organic satmat, very strong diesel odor in upper 0.5 ft. Satmat becoming more silty with depth, 1 ft is silt with organic, black. 1.5 ft is brown to black silt. Diesel odor is moderate at 1 ft, faint at 1.5 ft. Samples bagged from 1 and 1.5 ft. Pipe is above ground

PJ-2 - organic at surface, black to brown silt at 0.5 ft, gray silt at 1 ft, no diesel odor, sample collected from 1 ft. Pipe is above ground

PJ-3 - adjacent to valves on downslope side of jump road, pipe is at ground surface material is organic, at 0.5 ft silt + organic material, strong diesel odor
1 ft - Brown silt with minor sand, strong diesel odor
1.5 ft - SAND, medium, silty, gray.

1 Nov 2003

strong diesel odor, moist.
2 ft - same sediments as 1.5 ft, saturated, moderate petroleum odor, refusal at base

PJ-3 - below road, not sampled
PJ-5 - within 10 feet of PJ-4. Since PJ-4 has contamination, is very close to PJ-5, and is upslope, PJ-5 was not sampled. Fuel line is capped on upslope end at PJ-5, downslope end is open.

PJ-6 - organic material at surface
0.5 ft - organic material, slight diesel odor. 1.0 ft - organic material, as above. 1.5 ft - organic material, minor sand, slight diesel odor. Pipe is on ground

PJ-7 - organic material at surface
0.5 ft - organic material, slight diesel odor. 1.0 ft - medium sand to silt, w. organic material, gray to black, slight diesel odor 1.5 ft - As above, no diesel odor.
Area is burned [illegible] 0.5 ft

1 Nov 2003

PJ-8 - Located in area of standing water. 0.0 0.5 ft - silt, organic material, no diesel odor. 1.0 ft - gravel, sand, silt, organic material, no odor, refusal below 1.0 ft, soil column saturated. Pipe is partially buried.

PJ-9 - Located in area of standing water, adjacent to 0.5 ft thick refusal. Saturated at 0.5 ft bgs silt and organic material, slight diesel odor, Pipe is above ground.

PJ-10 - Organic material at surface 0.5 ft - dark gray silt, no petroleum odor, saturated.
1.0 ft - as above, slight diesel odor
1.5 ft - as above, no diesel odor
2 ft - on contact cobble or coarse gravel, refusal.
Pipe is above ground.

PJ-11 - organic material at surface and at 0.5 ft bgs
1.0 ft - silt with organics and med. sand, no diesel odor
1.5 ft - Gravel, medium, with
Pipe is buried @ 0.5 ft

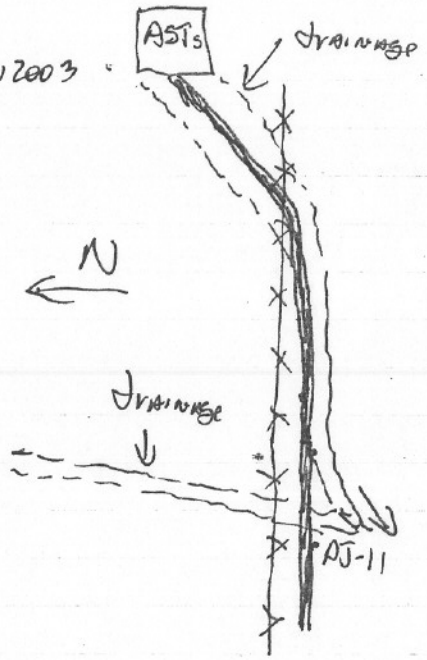
1 Nov 2003

clasts to 0.5" in auger, auger, with silt and medium sand, saturated, slight diesel odor. Refusal on cobble or gravel below 1.5 ft.

PJ-12 - surface - organic material, saturated 0.5 ft - Gravel, fine to med. (clasts up to 0.25" dia) with sand, med. to coarse, silt, and organic material, no diesel odor. 1.0 ft - same as above, no diesel odor, saturated. Pipe is above ground surface at this location, boring halted at 1.0 ft bgs.

- PJ-12 is adjacent to water drainage from different area than PJ-1 through 11. Drainage at PJ-12 is from west north from area upslope of former staff residence. ~~Area upslope of~~ PJ-1 through 11 drains area that includes former AST area. - See sketch on next page:

1 Nov 2003



PJ-15 - pipe is at ground surface at this location - surface - organic material - 0.5 ft - silt with organic material and coarse sand, saturated, slight diesel odor. 1.0 ft - As above, with greater fraction gravel and sand, moderate diesel odor. 1.5 ft - As above, moderate diesel odor. 2.0 ft - silt, dark gray to black, saturated, slight diesel odor. Refusal on ~~rock~~ cobble or gravel below 2 ft.

PJ-16 - surface - organic material, standing water, pipe is just below ground surface. 0.5 ft - silt with gravel and med. sand, saturated, slight diesel odor. 1.0 ft - As above, except moist, slight diesel odor.
- refusal below 1.0 ft, tree roots possible cause.

PJ-17 - surface - organic material, standing water.), pipe is buried in this area. 0.5 ft - silt and saturated organic material, very slight diesel odor. 1.0 ft - As above, no petroleum/diesel odor

- Pipe buried too deep for hand auger at PJ-13, 14, and 18.

1 Nov 2003

5:00 PID results of fuel line soil samples:

	0.5 ft	1 ft	1.5 ft	2 ft
PJ-1		[13]	4	
PJ-2		→0.8		
PJ-4		25	[216]	83
PJ-5				
PJ-6	[100]		[23]	
PJ-7	65	95	3.3	
PJ-8	6			
PJ-9	37			
PJ-10	38	27		
PJ-11		5	13	
PJ-12	4			
PJ-15	[241]	192	95	[89]
PJ-16	80	[129]		
PJ-17	15	33		

6:00 - Done for the day

To do Sunday

- water sample locations
- petro-flag on fuel line hand augers
- test auger on beach side of road
- step-out from fuel line, PJ-4, PJ-15
- map drainage

2 Nov 2003

0630 - Leave lodge

0645 - At site, Brent is on-site. I test auger on beach side of road, material is beach sand to ≈ 3 ft bgs, water encountered at 2 ft bgs, Hand-auger test hole and groundwater well install in this area should be possible. Sediment from ≈ 1 ft to 2 ft had very faint petroleum odor

0715 - Inspect wells on-site, well on SE corner is flowing from bleed valve, water collected around well has sheen, this flowing well appears to be source of surface water in this area.

- Water well at ~~the~~ midpoint of east side of property is covered by upside-down 5-gallon pail, also appears to be flowing as water is bubbling up from around the pail.

0843 - estimated depth of south water supply well = 92 feet, not positive on sounding with light probe (SI tape).

2 Nov 2003

0910 - Begin step-off soil borings at PJ-4, 2 feet to north - PJ-4N2 - surface organic material, 0.5 ft. organic material, moderate diesel odor. 1 ft - Silt, brown, very moist, strong diesel odor 1.5 ft - Sand, fine, silty, brown, moist, strong diesel odor. 1.5 ft - Sand, medium, silty, gray, with gravel. Saturated. Strong Diesel odor. Cobbly below 2 ft, auger hole halted.

- Next at offset 14 ft to find location for auger

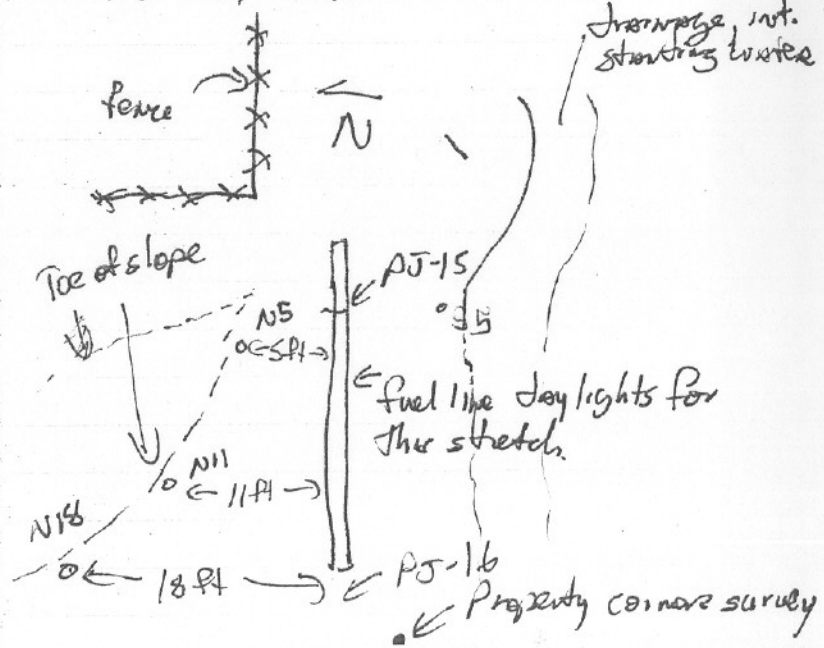
PJ-4-N14 - 0 - 0.5 ft - Organic material, strong diesel odor. 1 ft - Medium Sand, silty, saturated, with organics, moderate diesel odor 1 - 2 ft - As above, slight diesel odor. 2 ft - as above, no diesel odor. This location is approx. 7 ft west of 2" ID fuel line that is oriented North-south.

PJ-4-S5 - organic material surface to 0.5 ft, 1 ft - organic material and silt, slight petroleum odor, damp, 1.5 ft - Silt, with medium sand and organics, damp, slight petroleum odor.

2 Nov 2003

2 ft - Gravel, clasts to ½" dia, with brown sand, poorly sorted, and silt, brown, slight petroleum odor, ~~moist~~ wet. Saturated. moist 2.5 ft - As above, slight petroleum odor 3 ft, as above, saturated, no petroleum odor. halted at 3 ft, location is on south side of Pollen tree from PJ-4, and approx. 0.5 ft higher point.

1115 - examine offset area adjacent to PJ-15. Sketch:



2 Nov 2003

PJ-15-N5 - 0 Surface - organic material, very strong diesel odor., same to 0.5ft
1ft - medium to coarse sand, silt, and organic, gray, moist, moderate petroleum odor. 1.5ft - same as above, moderate petroleum odor, gravel at base. 1.75ft - gravel, saturated, strong diesel odor, refusal below.
PJ-15-N18 - surface organic to 0.5 ft, 1.0 - silt and organic, slight diesel odor 1.5ft - gravel, chests to 0.5" dia, with poorly sorted sand and silt, brown to dark gray, saturated, slight petroleum odor.
PJ-15-N11 - augered to 1 ft, slight petroleum odor, stopped on root.
PJ-15-S5 - surface - organic material to 1 ft, 1ft-1.5ft - Saturated silt and organic, strong diesel odor.
1.5ft - Gravel with coarse to medium sand, gray, saturated, strong diesel odor

2 Nov 2003

PID (ppm)

Depth	0.5	1	1.5	2	2.5	3
PJ 4-N2		20	2.2	2.9		
PJ 4-N14		2.2	2.9	2.9		
PJ4-S5		2.2	6.8 3.5	2.2	2.2	4.2
PJ15 N5		53	8.1	1.75 98		
PJ15 N18		2.2	2.9			
PJ15 S5		7.4	6.8			

- Walk site, mark surface water drainage and prospective sample points on site figure

Petro-Flag Results:

PJ-1-1ft	645 ppm
PJ-1-1ft	34
PJ-6-1.5ft	303
PJ-15-0.5ft	950
PJ-15-2ft	170
PJ-16-1ft	11,410
PJ-10-0.5ft	201
PJ-17-1ft	1047
PJ-4-N2-1ft	374
PJ-15-N5-1.75ft	3130
PJ-15-N18-1.5ft	18
PJ-15-S5-1ft	74

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COC 1 - SUMMARY

→ = PETROFLAG & LAB CORRELATION

CONTENTS

PAGE	REFERENCE		DATE
		*=HOT	
	PETRO	ANALYTICAL	
	TP-A-5		
11/1	TP-A-9 →	TP-A-9*	
	TP-A-10		
	TP-B-5 →	TP-B-3*	
	TP-B-7		
	TP-C-3 →	TP-C-3	
	TP-C-11.5		
	TP-D22		
	TP-D27 →	TP-D2-7	
	TP-D5-3 →	TP-D3-3	
11/2	TP-G1-3	TP-G1-6.5* (+PAH)	
	TP-G2-3 →	TP-G2-3	
	TP-G3-3	TP-H1-4 (COLUMN)	
		TP-I-8** (+PAH+DUP)	

PF: ALL.
13/0 (+PAH)
17 (2 PAH)
11/3 BK

TOTALS:	BK, KB	MR
ANALYTICAL:	9 (2 PAH) + 7 (2 PAH) (1 DUP)	
P.FLAG:	13	ASK ANNE 12

2

OCTOBER 30, 2003
COLD, CLEAR

B. KLIEFORTH
M. RIESER

0730 VISIT PUBLIC WORKS BUILDING.
0900 ARRIVE @ SITE. WALK SOUTHERN PERIMETER. SUPPLY PIPE IS ABOVE-GROUND. SEE OTHER FIELD BOOK.
1200 LUNCH & SUPPLY RUN.
1350 RESUME SITE WALK & SURVEY.

CDI DATA

POINTS: N STOP SIGN - NA
S STOP SIGN - NA
ELM N ✓
ELM S ✓
PIPEND (NEAR HOSPITAL)
SOUTHERN FENCE OPENING
FIRE HYDRANT

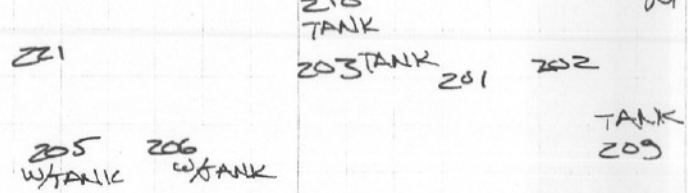
* NEED TO GROUND-TRUTH THESE, AS SOON AS CONVENIENT

OCTOBER 31, 2003
COLD, CLEAR

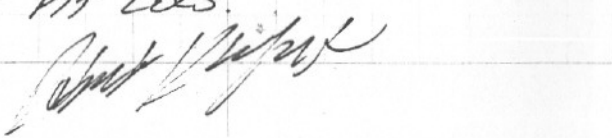
B. KLIEFORTH
M. RIESER

3

0640 ARRIVE @ SITE. WALK SITE W/ CDI DATA LOADED ON TRIMBLE GPS. STAKED CORNERS OF THE FOLLOWING BUILDINGS:



0900 BEGIN STAKING TEST PIT LOCS. AREA NEAR 3-WAY PIPELINE JUNCTION IS THE WEAKEST (FROM SURVEY-POINT-OF-VIEW).
1200 LUNCH.
1330 MEET W/ BOB COLDWELL (PUBLIC WORKS). HE PROVIDES RA ENV. TELLS REPORT. HE WILL LOOK INTO AIR PHOTOS & ELECTRONIC LAYERS OF THEIR GIS SYSTEM.
1430 BACK @ SITE. CONTINUE STAKING TEST PIT LOCS.



NOVEMBER 1, 2003

K. BOYESEN
M RIESER
B KUEHORTH

0630 ARRIVE @ SITE
PREP FOR SAMPLE & MEET EXCAVATOR
BRET WOODBURY
EX 160LC HITACHI — OUTSIDE TRACK DIM = 9'
EACH TRACK = 2.3' WIDE
SAFETY & LOGISTICS MEET
0730 LINE UP @ TP-A (PRINCIPALS OFFICE)

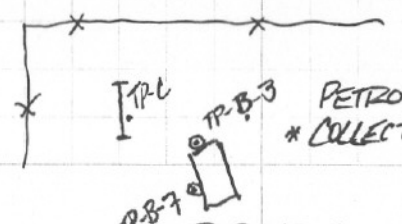
Lithology
0-3' - Gravel, coarse, with cobbles up to 6", with silt to coarse sand and organic material. GM
BLACK, DRY, UNSORTED, ROUNDED-SUBANGULAR
3-6' GM SAME. LESS ORGANICS. SEWER LINE & SEWER ODOR @ CLAY PIPE
RED, OXIDIZED ZONE 2-3' WIDE @ 6' ON SOUTH WALL. DISC. STRAW 1 @ 7'
6-9' (GP) FEA-SIZED GRAVEL W/ MINOR COARSER MATERIAL (UP TO 6" COBBLES). DRY.
MINOR SEWER & HYDROCARBON ODOR. BLACK.
MINOR FE STAINS DISCONTINUOUS.
COLLECTED SAMPLE @ 9.0' BGS
PID = 1
PETROFLAG = 6836 (TF = 7)
0830 * COLLECTED ANALYTICAL = TP-A-9

11-1-03 5

10' (SP) MOST MED-GR SAND W/ TRACE-MINOR PEA GRAVEL
BKLO GREY-STAINED W/ HYDROCARB ODOR
PID = 148
PETROFLAG = 2158 (TF = 7)
10.5 SATURATED. GROUNDWATER LEVEL

0910 COLLECTED S-SIDEWALL SAMPLE @ 6'5'
PETROFLAG = 186
0915 BEGIN BACKFILLING
FINAL DIMENSIONS: 10.5' DEEP, 10' LONG
0930 MOBE TO TP-B (DUPLEX BLDG)

0-3' BLACK ORGANIC (UPPER) REGOLITH
@ 3' CONCRETE PAD/TANK(?)
W/ 1" FLEXIBLE BLACK HOSES
1×1" STEEL LINE
PAD/TANK IS LOCATED UNDER TANK
LOCATION ON E. SIDE OF DUPLEX
DIMENSIONS: 5.8' × 10.8' × 2.2'
UNDERSIDE IS ROUGH CONCR
TOP IS SMOOTH



11-1-03

WATER @ 7.0' W/SHEEN

3'-7' SANDY GRAVEL, MOIST-WET, BLACK ROUNDED. DEBRIS = 5" CLAY CEMENT PIPE, 1" FLEX TUBING

1100 BEGIN BACKFILLING TP-B

1130 MOBE TO TP-C (NW CORNER DUPLEX)

0'-2' HIGHLY ORGANIC SOIL, BLACK, DRY

@2' 10" CORRUGATED PIPE HEADING: TOWARDS WATER MNO & FeO STAINING ~~NEAREST~~ 10" NORTH LOOKING EAST:

2-7' MED-GR. SAND & GRAVEL W/ MINOR-MOD. COBBLES & BOULDERS. BLACK, MOIST

7'-13' SAME LITHOLOGY. (DTW = 11.5' BGS) @ 11.5' 6" LAYER W/ MOSTLY MED GR. SAND. COLLECTED SAMPLE.

TOTAL DEPTH 13'. No DEFINITIVE HYDROC. ODOR

1215 TP-C-3 PETRO = 32*

TP-C-11.5 PETRO = 34

* COLLECTED ANALYTICAL SAMPLE

SAMPLES @ TP-C COLLECTED ADJACENT TO CORRUGATED PIPE 6' FROM N. END (MIDDLE OF FENCE W/ CROSSBAR)

1320 MOBE TO TP-D (3-JOINT PIPELINE JNCTN

@D1 @ SOUTH END: MED GRAINED SAND W/ GREY STAIN & STRONG HYDROC. ODOR @ 2'.

WATER COMING IN FAST @ SHALLOW (2' BGS) SEEP/SPRING.

@D2 0-1' ORGANIC & SAND LAYER

1'-7' FINE TO MED GRAINED SAND, MOIST. ABU STAIN.

3'-7' MODERATE SILT W/ POCKETS OF MINIMAL GREY STAIN

WATER SLOWLY SEEPING IN @ 7'

@ D3 0'-3 SAME AS D2.

SAMPLES:

1410 TP-D1-2' ⇒ OBVIOUS CONTAM. SATURATED

1420 TP-D2-2' ⇒ PETRO = EEEE (BLINKING) PID = OVER-RANGE

1440 TP-D2-7' ⇒ PETRO = 139 * COLLECTED ANALYTICAL

1430 TP-D3-3' ⇒ PETRO = 45 * COLLECTED ANALYTICAL

1600 FINISHING BACKFILLING TP-D

1630 (POST) PROCESS PT SAMPLES

8 11-2-03 KB, BK, MR
1.7°C OVERCAST

0610 ARRIVE ONSITE. MOBE TO TP-E (NEAR 205-16)
0710 COLLECT TP-E-3
DIG TO 4.5'
0-0.5' HIGHLY ORGANIC (SOIL & ROOTS)
0.5= 6" DIAM STEEL PIPE
ORIENTED W/TRENCH SE (TOWARDS HILL)
0.5-4.5 COARSE SAND, PEA GRAVEL, & COBBLES. HIGHLY FeO & MnO STAINED. SOME WOOD DEBRIS.
DIFFICULT TO ASCERTAIN ODOR...
(GROUND SURFACE HAS WATER)

0725 PID CALIBRATION = 103 ppm
KB ON PETRO CALIBRATION
0730 LINE UP @ TP-F (BASE OF HILL)
SAME LITHOLOGY AS TP-E... COARSE MATERIAL ABU MnO & FeO. WATER @ 5
COLLECTED SAMPLE @ 3.0' BGS
SLIGHT ODOR (HYDROCARBON?)

PID: TP-E-3 = Φ
TP-F-3 = Φ

0800 MOBE TO TP-G (3-WAY PIPE JNCTN)
@0.5'= 6" METAL PIPE (SEWAGE)
STRIKE = N-S
DEPTH = 6"

11-2-03 9

2" FUEL LINE (STEEL) STRIKE DIFFICULT TO ASCERTAIN (MAY HAVE BEEN JET DEEP)
~4" WOOD STOVE PIPE STRIKE: N-S

0-.5 SOIL, ROOTS, ORGANICS
.5-6.5 COARSE SAND, GRAVEL, & FRIABLE SHALE BEDROCK & COBBLES
ABU. FeO &
ABU HYDROCARBON ODOR & GREY STAIN @ 2'-6.5' (6.5'= WATER) (ABU FeO & SHEEN)

COLLECTED BAGS:
0830 TP-G1-3'
0840 TP-G1-6.5'

MOVE ~20' DOWNGRADIENT TO TP-G2
MORE 2" FUEL PIPE @ 0.5'
@LEAST 20' OF PIPE W/HYDROCARBON-LIKE LIQUID INSIDE PIPE (GALVANIZED)
LITHOLOGY = SAME. (HOWEVER NOT THE SAME PROLIFIC STAINING)
WATER HAS SLIGHT SHEEN
0845 TP-G2-3'
MOVE ~20' DOWNGRADIENT TO TP-G3
0'-3' ORGANIC RICH SAND & SOIL
0850 TP-G3-3

11-2-03

WATER COMING IN... @ 3' W/SLIGHT SHEEN

PETROFLAG: TP-G1-3 PETRO= 93
TP-G2-3 = 3
TP-G3-3 = 28

ANALYTICAL SAMPLES: TP-G-6.5 (PAH 1700)
TP-G2-3

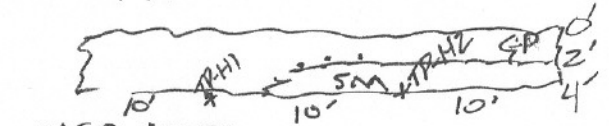
NOTE: FUEL LINE REMAINS IN PLACE ON THE SLOPE 20' S. OFFSET FROM THE G SAMPLE LINE

LAB NOTE: G PETRO SAMPLES ALL MOIST-WET
G3 = HIGH ORGANIC CONTENT
TP-G1-6.5 = SATURATED & HOT
TP-A & TP-B SAMPLES SHOULD HAVE CVC WARNING

1020 LINE UP ON TP-H (EAST LIMIT OF 3-PT)
PUT IN ~30' TRENCH CONNECTING CONTAM. ZONE W/NON CONTAM ZONE

1045 PID: TP-H1-4 0.9 ppm
TP-H2-4 0.2 ppm

LOOKING NORTH:



• = WATER SEEPS

11-2-03

5M LENS SEEMS TO DEMARK CONTAM. FROM NON-CONTAM. ALSO WATER IS SEEPING IN FROM ABOVE & TO THE WEST SIDE, BUT NOTED/ON THE 5M

1100 PROCESS 4 PT PETROFLAG SAMPLES
GPS LOCS

1145 MOVE TO TP-I (SE CRNR BLDG 203)
0-2 BLACK ORGANIC RICH SOIL
@1' CLAY SEWER PIPE & TRANSITE (WHITE VERSION) PIPE
2'-8' COARSE SAND & GRAVEL W/COBBLES
GREY STAIN & H.C. ODOR = STRONG
MINOR FeO. GREY IS PERVASIVE

1200 BAG TP-I-2.5 @ TOP OF CONTAM. PID=40

1205 ★ TP-I-8.0 @ GW W/SHEEN

1240 LINE UP ON TP-J (N. OF I)
@3' HIT 3rd LINES ALL RUNNING N-S...
(CLAY) 2 x 6" DIAMETER (SEWER) LINES
(METAL) 2 x 1-2" DIAMETER (FUEL?) LINES

1300 LINE UP ON TP-K (W. OF J)
COLLECTED TP-K-3 PID= 1.0
TP-K-10 PID= 0.3

★ TP-I-8 → COLLECTED ANALYTICAL (+PAH) & DUP
TP-I-8 = TP-DUP-1

0'-1' HIGH ORGANIC SOIL & ROOTS
1½'-9' COARSE SAND GRAVEL, COBBLES
NO GREY STAINING OR ODOR
10' FINE-MED SAND = TOP OF WATER
GREY = NATURAL COLOR. NO ODOR.
1330 LUNCH
1350 MOBE TO TP-LABC (BETWEEN 201 & 203)
TP-L-3 PID = 6.8
TP-L-5 @ GW PID = 131
LITHOLOGY: SAME COARSE GP PRF GM
W/MOD. STAIN & ODOR (H.C.) & FeO
WATER W/ SHEEN
1450 TP-M (DOWNHILL)
0-.5 ORGANIC SOIL & ROOTS
.5-12 GM & SM PRF W/FeO & MnO. NO ODOR.
TP-M-3 PID = 1.0 (TR. WATER @ 12)
M-7 = 1.0
M-12 = 0.3
1515 TP-N (DOWNHILL)
0-0.5 = ORGANIC SOIL & ROOTS
0.5-10.5 SM & GM W/FeO. NO ODOR.
GW NOTE: TP-M & TP-N HAVE HIGHER FINES CONTENT. WATER IS MUCH DEEPER... BEING DIVERTED TO N OR S. (?)

TP-N TOTAL DEPTH = 10.5
TOP OF GWATER
NOTE: TP-N IS ~ 10' LOWER IN ELEV. THAN TP-M
1630 BACKFILL TP-N
NOTE: WELL DOWNGRADIENT OF DINING HALL PLUME WILL MOST LIKELY HAVE TO BE N. OR S. OF PROPOSED LOC. IN WORKPLAN... WHEREVER WE FIND GWATER (?).
1700 WALK W/M. RIEGER DISCUSS SCH. SAMPLING AND SAMPLING STRATEGY
1800 PROCESS PT SAMPLES.

11-5-05
COOL, OVERCAST

0646 MOBILIZE @ SITE. SET UP ON TP-O. (EAST CORNER OF MAIN OFFICE)

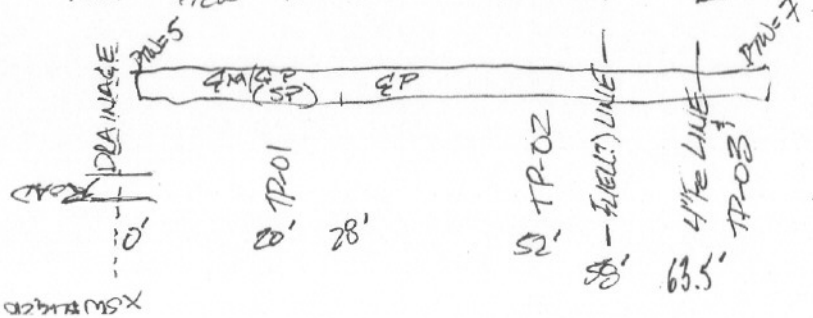
0-1' HIGHLY ORGANIC GP & ROOT MATERIAL
1-4.5' GM/GP W/MODERATE ORGANICS, BLACK, MOIST. NO HYDROCARBON ODOR OR STAIN.
4.5'-5.5' FINE-MED-GR. SAND, SATURATED.
* NO PID IN TRENCH. NO STAINS OR ODOR
* EXTEND TRENCH N/NORTH TOWARDS TP-I

0730 COLLECT TP-01-5 (SAND)
ATTACK. 10' N. OF TP-01-5: SAND UNIT DISAPPEARS AND GP EXTENDS TO 7' BGS

0750 COLLECT TP-02-3. (5' SOUTH OF E-W RUNNING PIPELINE) (1.5" DIAM)

0800 COLLECT TP-03-6 (GP W/ODOR & HYDROCARBON(?) ODOR

PLAN VIEW TP-O: 70' LONG



4-303

PETRO: TP-02-3 32 PPM
TP-03-6 OVERRANGE
WERE W/IN ~6' FT. OF TP-I, WHICH MAY BE S. EXTENT OF PLUME.

0915 MOBE TO TP-P
0-3' GM GW W/FEO MODERATE. NO STAINS. GM GW NO ODOR.
3'-6.5' GW W/GREY STAIN & HYDROCARBON ODOR
6.5' GROUNDWATER

0940 (COLLECTED) TP-P-6 (GP, WET) * COLLECT ANALYTICAL

PICS: LOOKING DOWN DRIVING FLOOR FIGURE
TP-I - FOREGROUND
TP-P - BACKGROUND (W/B.HOE)
ALSO SEE BLDG 203 (W/OUT FLAG)

1100 BACKFILL TP-P

1020 MOBE TO TP-Q (DOWNGRADIENT OF TP-P)
0-0.5' GM W/ORGANICS & ROOTS
0.5'-9.5 GW NO ORGANICS. NO STAIN. MOIST
@9.5 GW WET.

PETRO = TEMP ERROR
* COLLECTED ANALYTICAL

1030 COLLECT TP-Q-6
1040 COLLECT TP-Q-9.5 PID = 39 (SATURATED)

16 11-3-03

TP-Q APPEARS TO BE THE DOWNGRADIENT LIMIT FOR SOIL FOR THE DINING ROOM PLUME. WATER IMPACT PROBABLY CONTINUES FURTHER DOWNGRADIENT. PROBABLE LOCATION FOR WELL IS VERY NEARBY.

1115 TP-R (½WAY BETWEEN TP-K & TP-P)
TP-R IS GM w/MINOR FeO, NO ORGANICS
NO STAIN OR ODOR OF HYDROCARBONS
OFFSET 6' TOWARDS TP-P... STAINED & ODOR OF HYDROCARBONS @ 2'
TOOK MANY PICS. TP-R IS DEFINITIVE MARGIN OF DINING ROOM PLUME @ 5.6'
1135 COLLECT TP-R-6 (NE LIMIT, CLEAN GP)*
CONTINUE DIGGING TO 9.5 FEET
1145 COLLECT TP-R-9.5' (CONTAM. ? WET)*
WATER IS NOT RUSHING IN PIT. THIS IS NOT CONSISTANT w/NEARBY PITS.
WATER APPEARS TO BE EXTREMELY SELECTIVE AS TO PATH & DEPTH.
COLLECT ANALYTICAL
TP-R-6 (NO ODOR)
TP-R-9.5 (ODOR)

11-3-03 17

PTW = 11.0 (VERY TO of WATER, COMING IN SLOW)
BEGIN BACKFILLING
1230 LUNCH
1310 MOVE TO TP-S (CROSS GRADIENT)

GPS NOTES:
1) PATHFINDER OFFICE - UTILITIES/TOOLBAR - DATA TR. / FILE
GREENBALL LAPTOP CONNECT
2) GPSF-FILEDOWNLOAD - PROCESS WGS
COR - CORRECTED
GPS D.L. at WINDOWSCE
UTILITIES
DIFF. CORR ON
INTERNET
GLENN GUSTAVUS BYORKA

0-0.5' ORGANIC-ROOTS / GP
0.5-6.0 GM w/MINOR FeO, MINOR ODOR(?)
6.0-8.0 GM. MOIST-WET. TOP of GW @ 8.0'
COMING IN SLOWLY
1340 COLLECT TP-S-6
REPRESENTS SW MARGIN OF PLUME.
NEAR EDGE OF PLUME MOST LIKELY.
BEGIN BACKFILL
1420 MOVE TO TP-T
GIRL'S DERM

18 11-3-03

0'-3' SILT, SAND, ^ COARSE SAND w/ PEA GRAVEL & MINOR COBBLES. BLACK. MOIST-WET. NO HYDROCARBON ODOR. ~~BLACK~~ BK SEWER/ORGANIC ODOR-STRONG. ORGANIC CONTENT HIGH. POORLY CONSOLIDATED; TRENCH COLLAPSES EASILY. ⇒ OVERBURDEN/REGOLITH

3'-~~6.5~~ 6.5 SAME.

6.5-8 ~~SILT/SILTY SAND~~. MOIST-~~WET~~. NO HYDROCARBON ODOR. GREY COLOR... (NOT NEC. DEGRADED HYDROCARBON) GROUNDWATER COMING IN V. SLOW [redacted] DOES NOT LOOK AMENABLE TO PRODUCING WATER.

1520 GPS LOCS & FLAG S.W. SAMPLE LOCS CURRENT LOC FOR TP-T MAY BE IN OLD EXCAVATION

1900 LAB INVENTORY
17 10 PRES & 10 UNPRES / L. AMB.
6 VOAS + 3 TRIPS
6 SOIL (NON-TAGE)

1900 GPS RESEARCH ⇒ AUTOCAD DXF SETUP
W/ BLOCKS
W/OUT BLOCKS

11-4-03 BLUEGOLD & BOYESEN
5C

0440 ARRIVE @ SITE. MOBE TO TP-U
0-2' HIGHLY ORGANIC BLACK SOIL, MOIST.
2-3+' BLUE SILT. V. STIFF. NOT CONDUSIVE TO WATER FLOW.

0710 COLLECT TP-U-2 PETRO = 1 PPM

0720 ~~3'~~ 2' HIT

0'-2' REVISIT TP-T: HIGHLY ORGANIC SILT, SAND, GRAVEL, COBBLE, & LARGE BOULDERS W/ STRONG HYDROCARBON ODOR

2'-4' SAME LITHOLOGY. LESS ODOR.

4'- BLUE SILT.

0725 * COLLECT TP-T-1 PETRO = 418 1 GRAM

0730 TP-T-3 PETRO = 6 PPM

WATER FILLS TEST PITS FROM ABOVE THE SILT @ THE REGOLITH-SILT INTERFACE. THE SILT APPEARS TO BE AN EXTREMELY EFFECTIVE AT PREVENTING THE FLOW OF WATER AND/OR WATER-DIESEL MIX

* COLLECT ANALYTICAL + PPM: TP-T-1

0745 MOBE TO TP-V (DOWNGRADIENT)
0-4' GM & ORGANICS. MOIST. NO ODOR, NO STAIN.
4'-6' SM (WATER WEEPING IN 5-6')
6'-7' SM GRADES TO BLUE SILT
COLLECT TP-V-4 (GM-SM AND ABOVE)

11/4/03

0840 BEGIN BACKFILL
MOBE TO TP-X (MAPLE TREE PLUME)
0'-2' ORGANIC MATERIAL & GM
2'-4' SM GRADING TO BLUE SILT
0900 4'- COLLECT TP-X-3.5 SILT

NOTE: SM @ 3'+ HAS ODOR. WILL EXTEND TRENCH NORTH FOLLOW CONTAM.

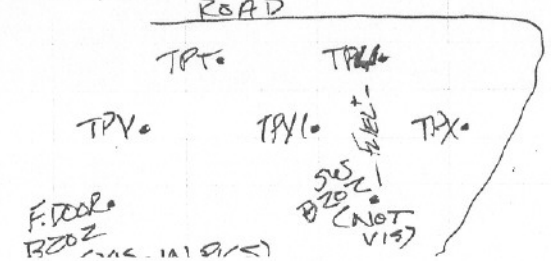
0910 COLLECT BAGS @ TP-X1-2.5-3 (ODOR)(GM)
0930 TP-X1-7 (SILT, NO ODOR)

NOTE SEVERAL WIRE-COIL LINE + 1 FUEL LINE BETWEEN TPX1 & BEGINNING OF TRENCH (TOOK PICS)

RETRO RESULTS

TP-X-3,5	(1g)*1	256 ppm
TP-X1-3	(10g)	643 ppm
TP-X1-7	(10g)	8 ppm
TP-Y-4	(10g)	13 ppm

PLAN VIEW



11-4-03

1100 TP-Y (W. OF MAPLE)
0'-5 GM & ORGANIC MATERIAL, MOIST NO H.C. ODOR.
5'-6' SM. GREY. MOIST. NO ODOR
WILL EXTEND TOWARDS TREE TO LOOK FOR H.C. IMPACT
@6' SM TRANSITIONS TO BLACK CLAY ALSO SEWER PIPE & ¼" STEEL PLATES/TANK APPEARS TO BE OLD SEWER TANK
@6' WATER SEEPING IN.
1125 COLLECT TP-Y-3 (TP-DUP-2) 0800
HIGHLY ORGANIC MATERIAL...
POSSIBLE %C OR TOC TO DIFFERENTIATE DRO RESULT FROM NATURAL ORGANIC MATERIAL
1200 MOBE TO TP-Z (W. OF FENCE)
0'-4' GM & ORGANIC MATERIAL, MOIST, NO ODOR. NO STAIN.
4'-5.5' SP, SM, & GM LENSES. NO ODOR. NO STAIN. WATER SEEPING IN @5.5
1210 COLLECT TP-Z-5 (SP, FINE-MED GRAINED)
DRO & TOC: REPRESENTATIVE OF SAND @ DEPTH @ TP-A & VICINITY. NOT UNLIKE BEACH SAND.)

5.5'-6.5'+ SP. NO ODOR.

1230 BACKFILL TP-Z

1245 MOBE TO TP-AA (OTHER SIDE OF ENTRY).
(NORTH OF DITCH, S. OF "MAPLE(?) TREE)
0'-2' REGOLITH. DRY-MOIST.
2'-6' SP. NO ODOR. NO STAIN.

1405 COLLECTED TP-AA-5 (NO ODOR, SP)

1315 LUNCH

1345 MOBE TO TP-BB
0'-5' GM & GP w/ CURSE OF ML, MOIST.
H.C. ODOR MODERATE
DISTINCT ML LAYER w/ ROOTS @ 2' (10" THICK)
BAGGED TP-BB-4.5
4.5-5.0+ BLUE ML

EXTENDED TRENCH SOUTH TO GET PAST POTENTIAL PLUME

PETRO: TP-BB-1.5 31
TP-BB-4.5 578 (odor)
TP-BB1-1. 10
TP-BB1-4.5 9

HINDSIGHT: STEPPED OUT TO FAR ON BB1
COULD HAVE PULLED IT IN CLOSER

1500 BEGIN BACKFILLING

1515 TP-CC (DOWNHILL)
0-2 GM & GP
2-2.5 ML w/ ROOTS (SAME AS BB)
2.5-4.5 GM & GP
4.5-5.0'+ ML & SM
COLLECT TP-CC-1 15 ppm (PETRO)
@ 7.0 ML
TP-CC-6.5 6 ppm (PETRO)

1600 MOBE OFF SITE. CLEAN UP.
MOBE TO AIR CARGO.

1800 END OF DAY

11-5-03
COLD & CLEAR

BK. & KB.

0850 ARRIVE @ SITE. SURFACE WATER & SED SAMPLE PREP.

0925 MOBE TO SW-1 (N. SIDE INSTITUTE AVE, NEAR FeO STAINED SEEP & SHEEN)

0930 SW-1

0820 SED-1

0840 MOBE TO SW-2 (E. SIDE ZIMOVIA)

0850 SW-2 (SW-DUP-1, 0900)

0900 SED-2 (SED-DUP-1 0100)

SW-2 & SED-2 IS LOCATED AT SEEP ON WEST-FACING BANK BETWEEN THE FENCE & THE ZIMOVIA HWY. ABUNDANT FeO & SHEEN AT SEEP. HYDROCARBON ODOR ALSO OBSERVED.

0930 UNLOAD WELL SUPPLIES. POSSIBLE SHIPPERS: BOYER, NORTHLAND

0950 ARRIVE AT SW-3 CULVERT W/ ORANGE HUE. CULVERT ON NORTH-NORTHWEST SIDE OF PROPERTY. FLOW IS A CONSTANT DRIP, 4' ABOVE CREEK BED OF INSTITUTE CREEK. IT IS EXTREMELY DIFFICULT TO FIND SEDIMENT SIZED PARTICLES @ OUTLET. OUTLET IS IN CREEK W/ HIGH ENERGY DEPOSITIONAL

ENVIRONMENT (ie. COARSE SAND & GRAVEL). INLET OF CULVERT IS NOT VISIBLE IT IS UNDOUBTEDLY CONNECTED TO THE BURIED DRAINAGE SYSTEM THROUGHOUT THE SITE.

1005 SED-3

1015 SW-3

1030 MOBE TO SW-4. NATURAL OUTLET THAT DRAINS SOUTH STAFF RESIDENCE. CREEK HAS LITTLE TO NO FLOW. SHEEN ON SEDS & SW.

1050 SW-4

1055 SED-4

1110 MOBE TO SW-5. NO FLOW - V. LITTLE FLOW ON WEST-FACING BANK. VISIBLE FROM ZIMOVIA HWY.

1120 SW-5

1125 SED-5

1130 MOBE TO SW-6. CULVERT @ NE CORNER OF PROPERTY DRAINING BELOW-GROUND CMPs ON SITE.

1151 SW-6 (FIELD DUP = SW-DUP-2 0200)

1200 SED-6

SED COLLECTED ADJACENT & BELOW CMP OUTLET

11-5-03

1230 LUNCH. TRASH RUN. FILE VAN. UPDATE OFFICE. CALL LAB.
1430 MOBE TO SW-7 (PT-B)
1435 SW-7 SHEEN ON WATER
1445 SED-7
1510 SED SW-8
1525 SED-8
REMOVED FROZEN WATER? SEDS TO GET SAMPLE.
1600 RECOVER BEACH FOR SW LOCS. NO SEEPS OBSERVED. DEFINITIVE
1700 RETURN TO LODGE. PACK WATER SAMPLE COOLER FOR TOMMOROW GOLDSTREAK.

Robert Wright

11-6-03 BK, RB
COLD, CLEAR

0645 ARRIVE @ SITE. FINALIZE COOLERS FOR SHIPMENT. SEND OFF.
SED/SOIL - 20
WATER - 10
WAYBILL - CALLED IN TO LAB
0830 MOBE TO MW-1 (FORMER GAS STATION)
1115 MOBE TO MW-2 (NE CORNER OF SITE)
0'-9.5' SM, MOIST. HIGH ORGANIC ODOR SMELL
MED-HIGH SILT/ORGANIC CONTENT
9.5' WATER SEEPING IN TEST PIT W/ SHEEN
LITH OF SM: SILT, SAND, GRAVEL, COBBLES, W/ROUNDED, MINOR BOULDERS.
POSSIBLE HYDROCARBON ODOR @ 8.5'
MINOR FAO @ ~8' BGS
1230 WELL CONSTRUCTION: 5' SCREEN
10' BLANK
TD = 13.5' BGS
SAND: 13.5' - 7.5
BENTONITE: 7.5 - 6.5
SAND:
1344 LUNCH
1530 MOBE TO MW-4. COLLECT CONSTRUCT WELL. ANTICIPATE 5' SCREEN?
10' BLANK

1415 0'-2' GM, HIGHLY ORGANIC.
MODERATE, DISC. STAINING
MOIST. SEWER PIPE (CLAY) @ 4'.
2'-8.5' GW, HYDROCARBON ODOR & STAIN
IS PERVASIVE. MINOR-MOD.
@ 8.5' GROUNDWATER COMING IN
SET BOTTOM of WELL IN @ 12.5
GREY STAINS ENTIRE COLUMN/32'
1515 MOBE TO MW-5 (DOWNGRADIENT of
TP-Q) (DOWNGRADIENT END of
DINING HALL PLUME)
LITH: GW, DRY, NO STAIN, WELL ROUNDED
GRAINS, NO ORGANICS
@ 5.0 ½'-THICK FCO LAYER
@ 9.5 STAINED GW, MOIST TO WET.
@ 9.8 WATER COMING IN FAST
SET 5' SCREEN @ TD = 13'
NOTE: IT WAS INEVITABLE THAT SOME
PRE-STAINED SOIL WAS BACKFILLED
AT A HIGHER ELEVATION THAN GW TABLE
(WHICH IS WHERE STAINING WAS FIRST
ENCOUNTERED)
1600 WELL COMPLETED.

ALL WELLS CONSTRUCTED W/SAND PACK
(2030 COLORADO SILICA) 1'-1.5' ABOVE THE
SCREEN & 1' BENTONITE SEAL
ABOVE (PURE GOLD MED. CHIPS 3/8")
1630 WALK TO WELLS & TOP OFF
SAND ABOVE BENTONITE SEAL
1700 MOBE OFF-SITE. PAPERWORK.

30 11/7/03 BK, KB
COLD, CLEAR

0640 ARRIVE @ SITE. MOBE TO SOD MW-3.
0'-2' GM, MOIST. ROUNDED, MOD. ORGANICS
2'-3' SAME AS ABV FCO W/ MINOR GREY STAIN UNDERNEATH
3.5 COLLECT MW-3-3* WATER @ 3.5'
NOTES: 4' SCREEN INSTALLED @ ~6.5 BGS.
0800 FINISHING BACKFILL
TRIM SAND TO 1' ABOVE SCREEN.
*0820 ANALYTICAL: MW-3-3 (DRO+TOC)
0850 CUT-OFF MW-1. 38 3/4" 2" PVC.
KB WORKS ON DEVELOPMENT OF MW2.
0900 TP-DD (SOUTH STAGE LOT)
0-4.5 GM. HIGH ORGANICS. MOIST
@ 4.5-5.0 BLUE SILT. SOFT. DRY
NO H.C. ODOR OR STAIN IN TRENCH
TRENCH DIMENSIONS: 25'L x 5.5'D x 8'W
0920 SAMPLE: SM @ TP-DD-4 (NO ODOR)
0925 SM/ML @ TP-DD-5 (ODOR) (PAH, BTEX)
SOME OF THE SILT HAS UNIQUE COLOR. IT IS DISCONTINUOUS/PODIFORM. ODOR IS DIFFICULT TO DEFINE. IT APPEARS TO BE CONCENTRATED @ GM-ML INTERFACE, WHERE WATER IS SLOWLY SEEPING.

4-7-03 31

0945 TP-EE. (EAST OF MAPLE TREE)
0-3 GM. MOD ORGANICS. MOIST
@ 3' GREY STAINING W/ ODOR. MOIST-WET.
0950 TP-EE-7 (STAIN + ODOR GM)
TWO FLEX(?) LINES @ ~2'-3' BGS
@ 5' 6" DIAMETER PIPE. PARALLEL TO ROAD.
3'-7' PODIFORM STAINING.
1000 TP-EE-7 (NO STAIN, TOC + DRO, GM)
WATER SEEPING IN SLOWLY.
@ 7' ML. DRY.

1020 MW-6. (NEAR S. GATE)
0-7' GM. MOIST. NO STAIN. NO ODOR
7' WATER SEEPING IN W/ SHEEN.
1040 SET 5' SCREEN @ 8.5' (?) HOLE COLLAPSING
1115 TRIM SAND 1' ABOVE SCREEN.
MOBE TO TOWN FOR SUPPLIES + LUNCH
1200 RETURN TO SITE: KB DEVEL. WELL MW-6
BK WELL COMPLETION
CUT OFF 29.5" MW-4
CUT OFF 20" MW-5 (ROUGH CUT)
CUT OFF 4 5/8" MW-2 (AFTER DEVEL.)

11-7-03

1430 TP-FF (w/ELBOW)
0-2' SM, MOIST, NO STAIN. FUEL LINE @ 2'.
2'-6' SM, MOIST, DISC. STAIN AND ODOR
1445 @ 6' COLLECT TP-FF-6' (D,B,P) ANALYTICAL
EXTREMELY STRONG ODOR. DARK BLACK. SATURATED
@ 6.5+ BLUE ML @ (NO ODOR, NO MOISTURE)
1450 TP-FF-3 (MIN/NO ODOR)
1550 MOBE TO TP-GG-
0-5' SM, MOIST, NO STAIN, NO ODOR.
1615 COLLECT TP-GG-3
1620 MOBE TO TP-HH
0-3' SW, SATURATED @ 36", EXTREMELY STRONG SHEEN
@ 3' BLUE ML
1530 COLLECT TP-HH-2 (~40' DOWNHILL)
1540 MOBE TO TP-II SAME LITH. BOTH HAVE NOD/HIGH ORGANIC
NO ODOR, NO STAIN.
NO WATER.
1550 TP-II- (ANOTHER AST STEP OUT)
ML @ 1'. PREVIOUSLY EXCAVATED MATERIAL BY APPEARANCE (?)

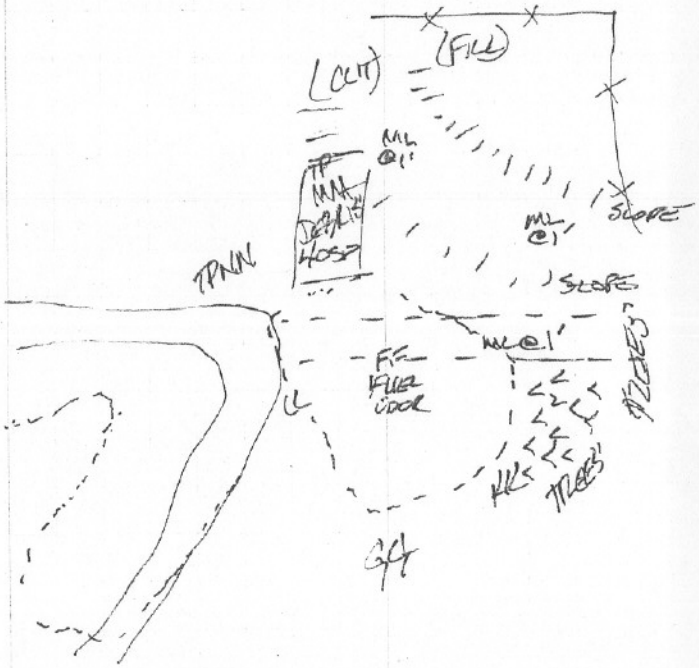
11-8-03 BK, KB
WARM (40s), CLEAR

0700 ARRIVE @ SITE. MOBE TO MW-7.
MOVED LOC DOWNHILL SLIGHTLY DUE TO UTILITY CONCERNS. (PRESSURIZED SEWER.)
0'-4' GW: SILT (MINOR), SAND, GRAVEL, & COBBLES & BOULDERS (UP TO 2' DIAM.). BLACK. DRY. SOME GRAVEL IS FILL. alo ODOR. NO STAINS.
0750 COLLECT MW-7-4 (COARSE SAND w/ SLIGHT ODOR)
LENSES OF THE COARSE SAND FROM 4'-
0800 COLLECT MW-7-7 (SAME. STRONG ODOR)
NO WATER. MATERIAL VERY WELL DRAINED
0815 MOBE ACROSS THE STREET
HIT SILT @ 1.0' BGS
0820 DEMOBE TO MW-7
SET @ ~8.0' BGS IN 6" ML
BEGIN WELL CONSTRUCTION & COMPLETION
TREMIE SAND TO 2' ABOVE SCREEN
BENTONITE = 6"
FLUSH MOUNT COMPLETION
1000 PETRO WORK

11-8-03

		PPM
RESULTS	TP-FF-3	536
	TP-FF-7	Ø
	TP-GG-3	62
	TP-II-2	22
	MW-7-4	994
	MW-7-7	439 (1 gram sample)

1110 MOBE TO MW-8
0'-8.5 GW. BLACK. DRY-MOIST. ROUNDED. NO ODOR. NO STAIN.
@2' RYC & POSSIBLY SEWER PIPE THAT MAY HAVE BEEN CONNECTED TO THE OLD WATER TREATMENT BLDG. STRIKE = E-W (2" DIAM.)
@ 8.5 WATER
@ 8.5-9.0 SP. COARSE ROUNDED SAND. NO FINES. MINOR PEA-GRAVEL. NO ODOR.
1230 COLLECT MW-8-8.5 (GS, JDC)
1240 SET WELL @ ~10.5'
BEGIN BACKFILL & WELL COMPLETION
1320 LUNCH.
1410 DEEMER-ORANGE SENT - 874-2301
1420 EXCAVATING S. OF TP-FF
@ TREELINE - SILT @ 1.0' BGS
@ ½ WAY... SAME
BOTH ON OLD ROADWAY



1440 TP-KK @ TREELINE
GM DOWN TO 5.5'. MOIST. NO ODOR.
SM/ML @ 5.5 MOIST. NO ODOR
ML @ 6.0' DRY. NO ODOR
1450 TP-KK-5.5
NO WATER. POOR PLACE FOR A WELL

11-8-03

TP-LL

0-5' GM. ODOR & BLACK STAIN.

1500 COLLECT TP-LL-5

TP-MM (EAST NORTHEAST OF THE ROAD)

0'-4' FILL: WOOD & METAL DEBRIS. TEST PIT FILLING W/H2O FROM DEBRIS VOIDS.

1530 TP-NN

0-4.0 GM. SAND DRY-MOIST. NO ODOR.

4-5 SILT. DRY. NO ODOR

PETRO:

	TPH
TP-KK-5.5	∅
TP-LL-5	674 (lg grain)
TP-NN-1.5	148
TP-NN-4	381

TO DO

* SOD (SE) - FIRESTONE CREEK - SOUTH OF (?)
* UST @ CITY OF AVALON (KISS C)
* TANKS 51 & 52 CHARGES MIKE (?)
* MIKE ⇒ PITS - PHOTOS
* FREE PROD 344-2177 (OLD MAPS)
  - LOGS - HOW MUCH/WK, CD DELIVERY
* MAP 28-

0700 ARRIVE @ SITE. KRISTEN STARTS DEVELOPING MW-7 & MW-8. BK START HAND AUGERING LOC @ SOUTH GATE (DOWNGRADIENT).

0840 BK ABANDONS EFFORT TO INSTALL WELL W/HAND AUGER.

0940 SAMPLE MW-2 = MW-DUP-1 + PAH (0800)

1015 SAMPLE MW-1

1040 SAMPLE MW-3 + PAH

1125 SAMPLE MW-4 + PAH

1200 LUNCH

1240 CONSTRUCT WELLS.

1325 WATER WELL #1 (NORTH)

1335 WATER WELL #2

1430 MOBE TO PROSPECTIVE MW-9

0-3' GM. NO ODOR. RED. ABD ORGANICS

3'-9' SP. FINE TO MED SAND. GREY. NO ODOR. MOIST.

1440 @6' MW-9-6

1458 SAMPLE MW-5 (PAH, DUP SAME PATH) MW-DUP-2 @ 0700

1500 SET WELL @ 9' BGS(?). LOTS OF SLOUGHING.

11-9-03

1520 MOBE TO PROSPECTIVE MW-10
@ CORNER: SILT @ 6.0' GM DRY.
1540 REMOBE NORTH.
0'-12' GM. GW. W/SP LENSES
(MED GRAINED). NO ODOR. MOIST.
MOD. ORGANIC.
NO WATER IN HOLE.
12'-14(?) HOLE SLOUGHING. SILT @ BOTTOM
TOE OF WELL CASING.
1600 MW-6 SAMPLED (PHH)
1630 WELL COMPETIONS @ MW-9 & MW-10.

11-10-03
RAINY, COLD

B. KLUEPFEL
K. BOYESEN

0700 ARRIVE @ SITE. WELL COMPLETIONS.
PACK COOLER & SEND OFF TO
ANALYTICA.
1020 MOBE TO TP-00 (SE CORNER AST)
0-3' GW. [illegible]
1035 TP-00-1
1040 TP-00-3
3.5' ML
1340 MOBE TO TP-[illegible]
0-1.5' GW. STAINED [illegible]
1.5-3.5' NEGM. BROWN. [illegible]
3.5 ML (BASE)
[illegible] TP-[illegible]
1050 TP TP-3
1100 MOBE TO TP-00
CURB/RADIANT OF DINING RM. PUMP
0-3' DRY-MOIST GW. BLACK. [illegible]
BUILDING ROOM REPAIRS.
NO @ 3' TP-00-3
1120 6-7' SP. MOIST (dry) ODOR-NAPHTHA.
SLIGHT ODOR @ 7'. PID [illegible]
1125 TP-00-7
-15' SP [illegible]
(Sand) [illegible]
1135 TP-[illegible]-3.5 [illegible]

1215 LUNCH.
1300 DEVELOP MW-10 W/ PERISTALTIC.
(BAILER WON'T GO DOWN)
1400 MOBE TO TP-RR
UPHILL OF QQ.
1430 COLLECT TP-RR-7
SAME CATH AS QQ.
NO STAINS. NO ODOR
1500 REC'D

		RPM	
	TP-00-1	1091	
	TP-00-3	4	
TP-DUP-4 ANALYTICAL	TP-PP-1	465	(1 gram)
	TP-PP-3	473	
	TP-QQ-3	278	
	TP-QQ-8.5	15	(1 gram)

1600 RA/FELLS STOCKPILE
2.5 MILES SW SAND RD
~ 60' x 60' x 10' HIGH @ HIGHEST
VERY LOW FALCON LIGHTING ZONE
NOT LINED

BK & KB

1-11-05
WARM, OVERCAST

0700 ARRIVE @ SITE. KG SAMPLING MW-7.
BK COMPLETING WELLS MW-9 & MW-10.
0825 MW-9 DTW: 4.02
TD: 9.45'
NOTE.. TOC ON SAMPLE READING & WILL BE DIFFERENT THAN LEVEL.
~ 4" CUT OFF INNER PVC.
1000 GPS
1135/1130 SED-9, SW-9
ADJACENT TO MW-8
IN INSTITUTE CK, SOUTH BANK.
1400 STOCKPILE
(WATER)

1400 SP-1: 1'-2' COMPOSITE
1418 SP-2: 2'-3' COMPOSITE
→ SP-DUP
1435 SP-3: 1.5-2.0
1455 SP-4: 1-1.5

→ TOWN

	FORE	BACK	HEIGHT
STATION #1	MW-2		0.91
	BLM		6.34
	MW-8		11.20
STATION #2		MW-2	10.80
	MW-1		5.27
	MW-3		0.29
#3		MW-3	10.98
	MW-5		8.55
	MW-4		5.17
	MW-9		3.04
#4		MW-9	1.87
	MW-10		3.20
	MW-6		11.04
		MW-5	3.36
#5			
		BLM	~7.6
	MW-7		12.15

MW-1 → MW-3	234.0'
MW-2 → MW-3	211.2'

COC 2 - SUMMARY

* = HOT

	LAB	PETRO
11/3	TP-P-6 *	TP-O2-3
		TP-O8-6
	TP-Q-6	TP-Q-6
	TP-R-6	
	TP-R-9.5	
	TP-S-6	
11/4	TP-T-1 (+PAH/BTEX)*	TP-T-1
		TP-T-3
		TP-U-2
	TP-X-3.5*	TP-X-3.5
	TP-Y-3	TP-X1-3
		TP-X1-7
		TP-V-4
	TP-Z-5 (TOC)	TP-BB-1.5
	TP-AA-5	TP-BB-4.5
		TP-BB1-1.0
		TP-BB1-4.5
11-7	TP MW-3-3 (TOC)	
	TP-DD-4 (DRO)	
	TP-DD-5 (D,B,P)*	
	TP-EE-3 (D)	
	TP-EE-7 (D, TOC)	
	TP-FF-6 (D,B,P)*	
	TP-HH-7 (D,B,P)*	

	LAB	PETRO
11/3	MW-8-8.5 (TOC)	TP-FF-3
0800	TP-DUP-3 *	TP-FF-7
	TP-LL-5 *	TP-GG-3
		TP-II-2
		MW-2-4
		MW-7-7

LAST COC

TP-DUP-4, 0800* (DRO)

= TP-PP-1, 1045*

TP-KK-5.5 1450 (TOC)

= TP-DUP-5 1850

SOIL SAMPLING STRATEGY

1) COLLECT 2/L PETRO & ANALYTICAL2 COMPARISON SAMPLES
2) COLLECT AT LEAST 1 ANALYTICAL PER "UNCLOSED" AREA. PREFERABLY 2 (1 CLEAN & 1 CONTAMINATED)
3) ANALYTICAL SAMPLE PREFERENCE - DRY/MOIST BETTER THAN SATURATED
4)

APPENDIX E

WELL SAMPLING CALCULATION AND RECORD SHEETS

SLR Alaska
2525 Blueberry Road
Suite 206
Anchorage, Alaska 99503
phone (907) 222-1112
fax (907) 222-1113

Monitoring Well Development Record Sheet

Client: ADEC
Site Name: Wrangell Institute
SLR Employee: K. Boyesen

Well Number: MW-1
SLR Project #: 005.00165.03003
Date: 11/7/03

WELL COMPLETION INFORMATION

Date Well Completed: 11-6-03
Was well developed by drilling contractor? yes no
Method: Backhoe

COLUMN OF WATER IN WELL PRIOR TO DEVELOPMENT

Well Casing Diameter (inches): 2
Filter Pack Diameter (inches): 4

Sounding Depth of Well (from top of casing [feet]):	~~(KB) 7.75~~ 11.70
Static Water Depth (from top of casing [feet]):	7.75
Column of water in well (feet):	3.95
Time Waterlevels Measured:	1305

VOLUME TO BE PRODUCED (3 **well casing** and filter pack volumes, unless otherwise specified)

Gallons per foot of filter pack (on reverse) **(a)**	=	0.13	
Column of water in filter pack **(b)**	x	3.95	
Volume of water column in filter pack **(c)= a x b**	=	0.51	[1]
Gallons per foot of casing (on reverse) **(d)**	=	0.163	
Column of water in well **(e)**	x	3.95	
Volume of water in casing **(f) = d x e**	=	0.65	[2]
Total water volume (filter pack [1] + casing[2]) **(g)**	x	1.16	
Number of volumes to be evacuated **(h)**	=	3	
Total volume to be evacuated **(i)=g x h**	=	3.48	

Pumping Method: Bailer (polyethylene) and 5 gallon bucket

Was Well Surged During Development? yes no
Method:
Total volume purged 7.0 gallons
Withdrawal Rate:

ADDITIONAL INFORMATION/COMMENTS: Turbid, Dark rusty brown in color turning to a lighter rusty brown during mid development. No noticable hydrocarbon-like odor or sheen. Excellent producer.

SLR Alaska
2525 Blueberry Road
Suite 206
Anchorage, Alaska 99503
phone (907) 222-1112
fax (907) 222-1113

Monitoring Well Development Record Sheet

Client: ADEC
Site Name: Wrangell Institute
SLR Employee: K. Boyesen

Well Number: MW-2
SLR Project # : 005.00465.03003
Date: 11-7-03

WELL COMPLETION INFORMATION

Date Well Completed: 11-6-03
Was well developed by drilling contractor? yes (no)
Method: Backhoe

COLUMN OF WATER IN WELL PRIOR TO DEVELOPMENT

Well Casing Diameter (inches): 2
Filter Pack Diameter (inches) : 4
Sounding Depth of Well (from top of casing [feet]): 15.00
Static Water Depth (from top of casing [feet]): 11.91
Column of water in well (feet): 3.09
Time Waterlevels Measured: 0825

VOLUME TO BE PRODUCED (3 **well casing** and filter pack volumes, unless otherwise specified)

Gallons per foot of filter pack (on reverse) **(a)**	=	0.13	
Column of water in filter pack **(b)**	x	3.09	
Volume of water column in filter pack **(c)= a x b**	=	.40	[1]
Gallons per foot of casing (on reverse) **(d)**	=	0.163	
Column of water in well **(e)**	x	3.09	
Volume of water in casing **(f) = d x e**	=	.50	[2]
Total water volume (filter pack [1] + casing[2]) **(g)**	x	.90	
Number of volumes to be evacuated **(h)**	=	3	
Total volume to be evacuated **(i)=g x h**	=	2.70	

Pumpling Method: Polyethylene Baiter and 5 gallon bucket

Was Well Surged During Development? (yes) no
Method: Bailer
Total volume purged 3.50 gallons
Withdrawal Rate:

ADDITIONAL INFORMATION/COMMENTS: Slight-moderate amount of silt, light Rusty-Brown color. No obvious hydrocarbon-like odor or sheen. Good recharge

SLR Alaska
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Suite 206
Anchorage, Alaska 99503
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fax (907) 222-1113

Monitoring Well Development Record Sheet

Client: ADEC
Site Name: Wrangell Institute
SLR Employee: K. Boyesen
Well Number: MW-3
SLR Project # : 005.0065.03003
Date: 11-8-03

WELL COMPLETION INFORMATION

Date Well Completed: 11-7-03
Was well developed by drilling contractor? yes ~~no~~
Method: Backhoe

COLUMN OF WATER IN WELL PRIOR TO DEVELOPMENT

Well Casing Diameter (inches): 2
Filter Pack Diameter (inches) : 4
Sounding Depth of Well (from top of casing [feet]): 8.62
Static Water Depth (from top of casing [feet]): 4.10
Column of water in well (feet): 4.52
Time Waterlevels Measured: 1405

VOLUME TO BE PRODUCED (3 **well casing** and filter pack volumes, unless otherwise specified)

Gallons per foot of filter pack (on reverse) **(a)**	=	0.13	
Column of water in filter pack **(b)**	x	4.52	
Volume of water column in filter pack **(c)= a x b**	=	0.59	[1]
Gallons per foot of casing (on reverse) **(d)**	=	0.163	
Column of water in well **(e)**	x	4.52	
Volume of water in casing **(f) = d x e**	=	0.74	[2]
Total water volume (filter pack [1] + casing[2]) **(g)**	x	1.33	
Number of volumes to be evacuated **(h)**	=	3	
Total volume to be evacuated **(i)=g x h**	=	3.99	

Pumpling Method: Polyethylene Bailer and 5gallon bucket

Was Well Surged During Development? yes no
Method:
Total volume purged 4.50 gallons
Withdrawal Rate:

ADDITIONAL INFORMATION/COMMENTS: No noticable hydrocarbon-like odor or Sheen. Turbid, rusty brown Color. moderate producer

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Monitoring Well Development Record Sheet

Client: ~~SLR~~ ADEC
Well Number: MW-4
Site Name: Wrangell Institute
SLR Project #: 005.0065.03003
SLR Employee: K. Boylesen
Date: 11-7-03

WELL COMPLETION INFORMATION

Date Well Completed: 11-6-03
Was well developed by drilling contractor? yes (no)
Method: Backhoe

COLUMN OF WATER IN WELL PRIOR TO DEVELOPMENT

Well Casing Diameter (inches): 2
Filter Pack Diameter (inches): 4
Sounding Depth of Well (from top of casing [feet]): 12.45
Static Water Depth (from top of casing [feet]): 9.25
Column of water in well (feet): 3.20
Time Waterlevels Measured: 1345

VOLUME TO BE PRODUCED (3 **well casing** and filter pack volumes, unless otherwise specified)

Gallons per foot of filter pack (on reverse) **(a)**	=	0.13	
Column of water in filter pack **(b)**	x	3.20	
Volume of water column in filter pack **(c)= a x b**	=	0.42	[1]
Gallons per foot of casing (on reverse) **(d)**	=	0.163	
Column of water in well **(e)**	x	3.20	
Volume of water in casing **(f) = d x e**	=	0.52	[2]
Total water volume (filter pack [1] + casing[2]) **(g)**	x	0.94	
Number of volumes to be evacuated **(h)**	=	3	
Total volume to be evacuated **(i)=g x h**	=	2.82	

Pumpling Method: Polyethylene Bailer and 5 gallon bucket

Was Well Surged During Development? yes no
Method:
Total volume purged ≈1.25 gallons
Withdrawal Rate:

ADDITIONAL INFORMATION/COMMENTS:

Noticable hydrocarbon-like sheen. Strong hydrocarbon-like odor. Poor producer - Bailed dry at approximately one gallon in volume purged.

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Monitoring Well Development Record Sheet

Client: ADEC
Site Name: Wrangell Institute
SLR Employee: K. Boycsen

Well Number: MW-5
SLR Project #: 005.0065.03003
Date: 11-7-03

WELL COMPLETION INFORMATION

Date Well Completed: 11-6-03
Was well developed by drilling contractor? yes (no)
Method: Backhoe

COLUMN OF WATER IN WELL PRIOR TO DEVELOPMENT

Well Casing Diameter (inches): 2
Filter Pack Diameter (inches): 4
Sounding Depth of Well (from top of casing [feet]): 13.21
Static Water Depth (from top of casing [feet]): 10.47
Column of water in well (feet): 2.74
Time Waterlevels Measured: 1410

VOLUME TO BE PRODUCED (3 well casing and filter pack volumes, unless otherwise specified)

Gallons per foot of filter pack (on reverse) **(a)**	=	0.13	
Column of water in filter pack **(b)**	x	2.74	
Volume of water column in filter pack **(c)= a x b**	=	.36	[1]
Gallons per foot of casing (on reverse) **(d)**	=	0.163	
Column of water in well **(e)**	x	2.74	
Volume of water in casing **(f) = d x e**	=	.45	[2]
Total water volume (filter pack [1] + casing[2]) **(g)**	x	.81	
Number of volumes to be evacuated **(h)**	=	3	
Total volume to be evacuated **(i)=g x h**	=	2.43	

Pumping Method: Polyethylene Bailer and 5 gal. bucket

Was Well Surged During Development? yes no
Method:
Total volume purged 2.75 gallons
Withdrawal Rate:

ADDITIONAL INFORMATION/COMMENTS: Moderate hydrocarbon-like odor and sheen. Light brown color. Moderate. Produced

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Monitoring Well Development Record Sheet

Client: ADEC
Well Number: MW-6
Site Name: Wrangell Institute
SLR Project # : 005.00165.03003
SLR Employee: K. Boyersen
Date: 11-8-03

WELL COMPLETION INFORMATION

Date Well Completed: 11-7-03
Was well developed by drilling contractor? yes ~~no~~
Method: Backhoe

COLUMN OF WATER IN WELL PRIOR TO DEVELOPMENT

Well Casing Diameter (inches): 2
Filter Pack Diameter (inches) : 4
Sounding Depth of Well (from top of casing [feet]): 10.19
Static Water Depth (from top of casing [feet]): 5.47
Column of water in well (feet): 4.72
Time Waterlevels Measured: 1500

VOLUME TO BE PRODUCED (3 **well casing** and filter pack volumes, unless otherwise specified)

Gallons per foot of filter pack (on reverse) **(a)**	=	0.13	
Column of water in filter pack **(b)**	x	4.72	
Volume of water column in filter pack (c)= a x b	=	0.61	[1]
Gallons per foot of casing (on reverse) **(d)**	=	0.163	
Column of water in well **(e)**	x	4.72	
Volume of water in casing **(f) = d x e**	=	.77	[2]
Total water volume (filter pack [1] + casing[2]) **(g)**	x	1.38	
Number of volumes to be evacuated **(h)**	=	3	
Total volume to be evacuated **(i)=g x h**	=	4.14	

Pumpling Method: Polyethylene Bailer and 5 gallon bucket

Was Well Surged During Development? yes no
Method:
Total volume purged _____ gallons
Withdrawal Rate:

ADDITIONAL INFORMATION/COMMENTS: No noticable hydrocarbon-like odor. ~~Very~~ (LB) for (LB) Slight amount of hydrocarbon-like sheen visible. Bails down quickly, poor-moderate producer. medium brown in color turning clear halfway through well development

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Monitoring Well Development Record Sheet

Client: ADEC
Well Number: MW-7
Site Name: Wrangell Institute
SLR Project #: 005.0065.03003
SLR Employee: K Boyesen
Date: 11-9-03

WELL COMPLETION INFORMATION

Date Well Completed: 11-8-03
Was well developed by drilling contractor? yes (no)
Method: Backhoe

COLUMN OF WATER IN WELL PRIOR TO DEVELOPMENT

Well Casing Diameter (inches): 2
Filter Pack Diameter (inches): 4
Sounding Depth of Well (from top of casing [feet]): 6.11
Static Water Depth (from top of casing [feet]): 5.98
Column of water in well (feet): .43
Time Waterlevels Measured: 0735

VOLUME TO BE PRODUCED (3 **well casing** and filter pack volumes, unless otherwise specified)

Gallons per foot of filter pack (on reverse) **(a)**	=	0.13	
Column of water in filter pack **(b)**	x	.43	
Volume of water column in filter pack **(c)= a x b**	=	.04	[1]
Gallons per foot of casing (on reverse) **(d)**	=	0.163	
Column of water in well **(e)**	x	.43	
Volume of water in casing **(f) = d x e**	=	.07	[2]
Total water volume (filter pack [1] + casing[2]) **(g)**	x	.14	
Number of volumes to be evacuated **(h)**	=	3	
Total volume to be evacuated **(i)=g x h**	=	.42	

Pumping Method: Polyethylene Bailer and 5 gallon bucket

Was Well Surged During Development? yes no
Method:
Total volume purged 0.50 gallons
Withdrawal Rate:

ADDITIONAL INFORMATION/COMMENTS:

No noticable hydrocarbon-like odor or sheen. Lt rusty brown color. Moderate recharge for amount of water in well

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Monitoring Well Development Record Sheet

Client: ADEC
Site Name: Wrangell Institute
SLR Employee: K Boylesen
Well Number: MW-8
SLR Project #: 005.0065.03003
Date: 11-9-03

WELL COMPLETION INFORMATION

Date Well Completed: 11-8-03
Was well developed by drilling contractor? yes (no)
Method: Backhoe

COLUMN OF WATER IN WELL PRIOR TO DEVELOPMENT

Well Casing Diameter (inches): 2
Filter Pack Diameter (inches): 4
Sounding Depth of Well (from top of casing [feet]): 10.10
Static Water Depth (from top of casing [feet]): 7.64
Column of water in well (feet): 2.46
Time Waterlevels Measured: 0815

VOLUME TO BE PRODUCED (3 **well casing** and filter pack volumes, unless otherwise specified)

Gallons per foot of filter pack (on reverse) **(a)**	=	013	
Column of water in filter pack **(b)**	x	2.46	
Volume of water column in filter pack **(c)= a x b**	=	.32	[1]
Gallons per foot of casing (on reverse) **(d)**	=	0.163	
Column of water in well **(e)**	x	2.46	
Volume of water in casing **(f) = d x e**	=	.40	[2]
Total water volume (filter pack [1] + casing[2]) **(g)**	x	.72	
Number of volumes to be evacuated **(h)**	=	3	
Total volume to be evacuated **(i)=g x h**	=	2.16	

Pumping Method: Polyethylene Bailer and 5 gallon bucket - peristaltic pump

Was Well Surged During Development? yes no
Method:
Total volume purged 2.00 gallons
Withdrawal Rate:

ADDITIONAL INFORMATION/COMMENTS:

No noticable hydrocarbon-like odor or sheen. Poor recharge. medium brown color. Well is bailed - switched to peristaltic pump (lower foot bailed)

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Monitoring Well Development Record Sheet

Client: ADEC
Well Number: MW-9
Site Name: WRANGELL INSTITUTE
SLR Project # : 005.0065.03003
SLR Employee: K. BOYESEN
Date: 11-10-03

WELL COMPLETION INFORMATION

Date Well Completed: 11-9-03
Was well developed by drilling contractor? yes no
Method: BAILING

COLUMN OF WATER IN WELL PRIOR TO DEVELOPMENT

Well Casing Diameter (inches): 2
Filter Pack Diameter (inches) : 4
Sounding Depth of Well (from top of casing [feet]): 9.63
Static Water Depth (from top of casing [feet]): 5.17
Column of water in well (feet): 4.46
Time Waterlevels Measured: 1010

VOLUME TO BE PRODUCED (3 **well casing** and filter pack volumes, unless otherwise specified)

Gallons per foot of filter pack (on reverse) **(a)**	=	0.13	
Column of water in filter pack **(b)**	x	4.46	
Volume of water column in filter pack **(c)= a x b**	=	.58	[1]
Gallons per foot of casing (on reverse) **(d)**	=	0.163	
Column of water in well **(e)**	x	4.46	
Volume of water in casing **(f) = d x e**	=	.73	[2]
Total water volume (filter pack [1] + casing[2]) **(g)**	x	1.31	
Number of volumes to be evacuated **(h)**	=	3	
Total volume to be evacuated **(i)=g x h**	=	3.93	

Pumpling Method: Polyethylene Bailer and 5 gallon bucket

Was Well Surged During Development? yes no
Method:
Total volume purged 4.0 gallons
Withdrawal Rate:

ADDITIONAL INFORMATION/COMMENTS:

No noticable hydrocarbon-like odor or sheen. Moderate recharge. Chocolate brown in color

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Monitoring Well Development Record Sheet

Client: ADEC
Well Number: MW-10 (03)
Site Name: Wrangell Institute
SLR Project #: 105.0065.03003
SLR Employee: K Boyesen
Date: 11-10-03

WELL COMPLETION INFORMATION

Date Well Completed: 11-9-03
Was well developed by drilling contractor? yes (no)
Method: Backhoe

COLUMN OF WATER IN WELL PRIOR TO DEVELOPMENT

Well Casing Diameter (inches): 2
Filter Pack Diameter (inches): 4
Sounding Depth of Well (from top of casing [feet]): 11.30
Static Water Depth (from top of casing [feet]): 7.54
Column of water in well (feet): 3.76
Time Waterlevels Measured: 1000

VOLUME TO BE PRODUCED (3 **well casing** and filter pack volumes, unless otherwise specified)

Gallons per foot of filter pack (on reverse) **(a)**	=	0.13	
Column of water in filter pack **(b)**	x	3.76	
Volume of water column in filter pack **(c)= a x b**	=	.48	[1]
Gallons per foot of casing (on reverse) **(d)**	=	0.163	
Column of water in well **(e)**	x	3.76	
Volume of water in casing **(f) = d x e**	=	.61	[2]
Total water volume (filter pack [1] + casing[2]) **(g)**	x	1.09	
Number of volumes to be evacuated **(h)**	=	3	
Total volume to be evacuated **(i)=g x h**	=	3.27	

Pumping Method: Polyethylene Bailer and 5 gallon bucket

Was Well Surged During Development? yes no
Method:
Total volume purged _____ gallons
Withdrawal Rate:

ADDITIONAL INFORMATION/COMMENTS:
Well is bowed - will use peristaltic pump

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Well Sampling Calculation and Record Sheet

Client: ADEC
Site Name: Wrangell Institute
SLR Employee: K. Boysen
Well Number: MW-1
SLR Project #: 005.2025.03003
Date: 11-9-03

COLUMN OF WATER IN WELL

Well Casing Diameter (inches):	2	Filter Pack Diameter (if known [inches])	4
Sounding Depth of Well (from top of casing [feet])	11.75		
Static Water Depth (from top of casing [feet])	8.15		
Column of water in well (feet)	3.60		
Time Waterlevels Measured:	0950		

VOLUME TO BE PURGED

(3 **well casing** volumes only, unless otherwise specified)

Gallons per foot of filter pack (on reverse)	=	.013
Column of water in filter pack	x	3.60
Volume of water column in filter pack	=	.47
Gallons per foot of casing (on reverse)	=	0.163
Column of water in well	x	3.60
Volume of water in casing	=	.59
Total water volume (filter pack + casing)	x	1.06
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	3.18

Purging Method: Polyethylene Bailer and 5 gallon bucket

FIELD PARAMETERS

Time	Volume purged (gallons)	pH	Conductivity (µS)	TDS ~~(ppm)~~ mS	Temperature (F or C)	Turbidity	Color	Odor	ORP (mV Units)
1000	.5	6.9		020	47	High	H. Rusty brown	None	
1005	1.5	6.9		010	51	High			
1008	3.00	6.9		010	50	High			
1011	4.00	6.9		010	51	High			

Total volume purged: 5.00 gallons
Withdrawal Rate:
Sample Identification: MW-1
Sample Time/Date: 1015 11-9-03
Duplicate Collected? yes (no)
Duplicate Identification:
Signed Sampler: KB
Date:
Signed Reviewer:
Date:

ADDITIONAL INFORMATION/COMMENTS: No noticable hydrocarbon-like odor or sheen
Silty - Excellent recharge. DRO & BTEX

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Well Sampling Calculation and Record Sheet

Client: ADEC/ WRANGELL INSTITUTE
Well Number: MW-2
Site Name: WRANGELL INSTITUTE
SLR Project # :
SLR Employee: B KLIEFORTH
Date: 11-9-03

COLUMN OF WATER IN WELL

Well Casing Diameter (inches):	2"	Filter Pack Diameter (if known [inches])	4" PREPACK
Sounding Depth of Well (from top of casing [feet])	14.63		
Static Water Depth (from top of casing [feet])	10.25		
Column of water in well (feet)	4.38		
Time Waterlevels Measured:	0850		

VOLUME TO BE PURGED

(3 **well casing** volumes only, unless otherwise specified)

Gallons per foot of filter pack (on reverse)	=	0.13
Column of water in filter pack	x	4.38
Volume of water column in filter pack	=	0.572
Gallons per foot of casing (on reverse)	=	0.163
Column of water in well	x	4.38
Volume of water in casing	=	0.7172
Total water volume (filter pack + casing)	x	1.2892
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	3.866

Purging Method: BAILER

FIELD PARAMETERS

Time	Volume purged (gallons)	pH	Conductivity (µS) → TDS (ppm)	Temperature (F or C)	Turbidity	Color	Odor	ORP (mV Units)
0910	1	7.3	170	47		PALE BROWN	NO	
0914	2	6.6	180	46		"	NO	
0918	3	6.4	190	47		"	NO	
0922	4	6.4	180	47		ALMOST CLEAR	NO	

Total volume purged: 4 gallons
Withdrawal Rate: MODERATE PRODUCER
Sample Identification: MW-2
Sample Time/Date: 11-9-03 0940
Duplicate Collected? (yes) no
Duplicate Identification: MW-DUP-1 (0800)
Signed Sampler: Robert Kliefoth
Date:
Signed Reviewer:
Date:

ADDITIONAL INFORMATION/COMMENTS: SHEEN ON WATER. COLLECTED PAH.

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Well Sampling Calculation and Record Sheet

Client: ADEC
Site Name: WRANGELL
SLR Employee: BLIEFERT
Well Number: MW-3
SLR Project # :
Date: 11/9/03

COLUMN OF WATER IN WELL

Well Casing Diameter (inches): 2" Filter Pack Diameter (if known [inches]) 4" PREPACK
Sounding Depth of Well (from top of casing [feet]) 8.72
Static Water Depth (from top of casing [feet]) 4.12
Column of water in well (feet) 4.6
Time Waterlevels Measured: 1000

VOLUME TO BE PURGED

(3 **well casing** volumes only, unless otherwise specified)

Gallons per foot of filter pack (on reverse)	=	0.23
Column of water in filter pack	x	4.6
Volume of water column in filter pack	=	0.598
Gallons per foot of casing (on reverse)	=	0.163
Column of water in well	x	4.6
Volume of water in casing	=	0.7498
Total water volume (filter pack + casing)	x	1.33
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	3.99

Purging Method: BAILER

FIELD PARAMETERS

Time	Volume purged (gallons)	pH	Conductivity (µS) → TDS (ppm)	Temperature (F or C)	Turbidity	Color	Odor	ORP (mV Units)
1005	0.5	6.1	070	42		RUSTY RED BROWN		
1008	1	6.1	060	44		RUSTY RED BROWN		
1015	2	6.0	070	44		RUSTY RED BROWN		
1016	3	6.0	060	44		PALE RUSTY RED BROWN		
1018	4	6.0	060	44		PALE RUSTY RED BROWN		

Total volume purged: 4.0 gallons
Withdrawal Rate: MODERATE PURGE
Sample Identification: MW-3
Sample Time/Date: 11-9-03, 1040
Duplicate Collected? yes (no)
Duplicate Identification:
Signed Sampler: [signature]
Date:
Signed Reviewer:
Date:

ADDITIONAL INFORMATION/COMMENTS:

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Well Sampling Calculation and Record Sheet

Client: ADEC
Site Name: Wrangell Institute
SLR Employee: K Boyesen
Well Number: MW-4
SLR Project # : 105.0065.03003
Date: 11-9-03

COLUMN OF WATER IN WELL

Well Casing Diameter (inches):	2	Filter Pack Diameter (if known [inches])	4
Sounding Depth of Well (from top of casing [feet])	12.53		
Static Water Depth (from top of casing [feet])	9.31		
Column of water in well (feet)	~~3~~ 3.22		
Time Waterlevels Measured:	1055		

VOLUME TO BE PURGED

(3 **well casing** volumes only, unless otherwise specified)

Gallons per foot of filter pack (on reverse)	=	0.13
Column of water in filter pack	x	3.22
Volume of water column in filter pack	=	.42
Gallons per foot of casing (on reverse)	=	0.163
Column of water in well	x	3.22
Volume of water in casing	=	.36
Total water volume (filter pack + casing)	x	~~1.28~~ .78
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	~~3.84~~ 2.34

Purging Method: Polyethylene Bailer and 5 gallon bucket

FIELD PARAMETERS

Time	Volume purged (gallons)	pH	Conductivity (µS)	TDS (ppm) ~~ppt~~	Temperature (F or C)	Turbidity	Color	Odor	ORP (mV Units)
1105	0.60	6.6		160	47	High	beige/brn	Mod	
1109	1.00	6.5		170	47	High	"	"	
1113	1.50	6.5		170	47	Med	"	"	
1115	2.00	6.5		170	49	Mod.	"	"	
1117	2.30	6.5		170	49	Mod	"	"	

Total volume purged: 2.50 gallons
Withdrawal Rate:
Sample Identification: MW-4
Sample Time/Date: 1125 11-9-03
Duplicate Collected? yes (no)
Duplicate Identification:
Signed Sampler: KB
Date:
Signed Reviewer:
Date:

ADDITIONAL INFORMATION/COMMENTS: Noticable hydrocarbon-like odor and sheen moderate recharge
Analyze for BTEX, DRO and PAH

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Well Sampling Calculation and Record Sheet

Client: ADEC
Site Name: Wrangell
SLR Employee: K. Boysen
Well Number: MW-5
SLR Project #: 005.0005.03003
Date: 11-9-03

COLUMN OF WATER IN WELL

Well Casing Diameter (inches): 2	Filter Pack Diameter (if known [inches]) 4
Sounding Depth of Well (from top of casing [feet])	13.30
Static Water Depth (from top of casing [feet])	10.81
Column of water in well (feet)	2.49
Time Waterlevels Measured:	1400

VOLUME TO BE PURGED

(3 **well casing** volumes only, unless otherwise specified)

Gallons per foot of filter pack (on reverse)	=	0.13
Column of water in filter pack	x	2.49
Volume of water column in filter pack	=	.32
Gallons per foot of casing (on reverse)	=	0.163
Column of water in well	x	2.49
Volume of water in casing	=	.41
Total water volume (filter pack + casing)	x	.73
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	2.19

Purging Method: Polyethylene Bailer and 5 gallon bucket

FIELD PARAMETERS

Time	Volume purged (gallons)	pH	Conductivity (µS)	TDS (ppm)	Temperature (F or C)	Turbidity	Color	Odor	ORP (mV Units)
1410	0.5	6.4		130	49	Mod	med brown	mod	
1412	1.25	6.4		120	49				
1415	1.75	6.4		110	48				
1418	2.25	6.4		110	49				
1421	2.50	6.4		110	49				

Total volume purged = 2.60 gallons
Withdrawal Rate:
Sample Identification: MW-5
Sample Time/Date: 1426 11-9-03
Duplicate Collected? (yes) ~~no~~ KB
Duplicate Identification: MW-Dup-2 0200
Signed Sampler: KB
Date:
Signed Reviewer:
Date:

ADDITIONAL INFORMATION/COMMENTS: Noticable hydrocarbon like sheen - Good recharge

BTEX, DRO, PAH Duplicate analyzed for BTEX DRO

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Well Sampling Calculation and Record Sheet

Client: ADEC
Well Number: MW-6
Site Name: WRANGELL INSTITUTE
SLR Project # :
SLR Employee: KLIEFOTH, BOYESEN
Date: 11-9-03

COLUMN OF WATER IN WELL

Well Casing Diameter (inches): 2"
Filter Pack Diameter (if known [inches]) 4" PRECONSTRUCTED
Sounding Depth of Well (from top of casing [feet]) 10-28
Static Water Depth (from top of casing [feet]) 5.44
Column of water in well (feet) 4.54
Time Waterlevels Measured: 1515

VOLUME TO BE PURGED

(3 **well casing** volumes only, unless otherwise specified)

Gallons per foot of filter pack (on reverse)	=	0.13
Column of water in filter pack	x	4.54
Volume of water column in filter pack	=	~~.79~~ .63
Gallons per foot of casing (on reverse)	=	0.163
Column of water in well	x	4.54
Volume of water in casing	=	.79
Total water volume (filter pack + casing)	x	1.42
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	4.26

Purging Method: BAILER

FIELD PARAMETERS

Time	Volume purged (gallons)	pH	Conductivity (µS)	TDS (ppm)	Temperature (F or C)	Turbidity	Color	Odor	ORP (mV Units)
1525	0.50	6.8		280	46	—	clear	NONE	
1530	1.00	6.9		280	46	LOW	lt brown	NONE	
1533	1.75	6.8		290	46		lt brown/gray		
1540	2.25	6.9		290	46		gray		
1546	3.50	6.9		280	46		lt gray		
1555	4.25	6.9		290	46		"		

Total volume purged: 4.50 gallons
Withdrawal Rate:
Sample Identification:
Sample Time/Date: 1600 11-9-03
Duplicate Collected? yes (no)
Duplicate Identification:
Signed Sampler: KB
Date:
Signed Reviewer:
Date:

ADDITIONAL INFORMATION/COMMENTS: No NOT able hydrocarbon-like sheen or odor. Poor to moderate recharge.

BTEX, DRO, RRO

SLR Alaska
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Suite 206
Anchorage, Alaska 99503
phone (907) 222-1112
fax (907) 222-1113

Well Sampling Calculation and Record Sheet

Client: ADEC
Site Name: Wrangell Institute
SLR Employee: K. Boylsen
Well Number: MW-7
SLR Project # : 005.0065.03003
Date: 11-10-03 (VB)

COLUMN OF WATER IN WELL

Well Casing Diameter (inches): 2	Filter Pack Diameter (if known [inches]) 4
Sounding Depth of Well (from top of casing [feet])	6.51
Static Water Depth (from top of casing [feet])	5.58
Column of water in well (feet)	.93
Time Waterlevels Measured:	0740

VOLUME TO BE PURGED (3 **well casing** volumes only, unless otherwise specified)

Gallons per foot of filter pack (on reverse)	=	0.13
Column of water in filter pack	x	0.93
Volume of water column in filter pack	=	.12
Gallons per foot of casing (on reverse)	=	0.163
Column of water in well	x	0.93
Volume of water in casing	=	.15
Total water volume (filter pack + casing)	x	.27
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	.81

Purging Method: ~~Polyethylene Bailer and 5 gallon Bucket (B)~~ Peristaltic pump

FIELD PARAMETERS

Time	Volume purged (gallons)	pH	Conductivity (µS)	TDS (ppm) ~~ts~~	Temperature (F or C)	Turbidity	Color	Odor	ORP (mV Units)
0750	.25	6.8		000	47		Clear	Slight	
0753	.50	6.7		010	46		Clear	Slight	
0756	.75	6.7		000	47		Clear	Slight	
0759	1.00	6.8		000	47		Clear	Slight	

Total volume purged: 1.20 gallons
Withdrawal Rate:
Sample Identification:
Sample Time/Date: 0815 11-11-03
Duplicate Collected? yes (no)
Duplicate Identification:
Signed Sampler: Date:
Signed Reviewer: Date:

ADDITIONAL INFORMATION/COMMENTS: No noticable hydrocarbon-like sheen. Slight hydrocarbon like odor. Good recharge

BTEX, DRO, PAH

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Well Sampling Calculation and Record Sheet

Client: ADEC
Well Number: MW-8
Site Name: Wrangell Institute
SLR Project #: 005.0065.03003
SLR Employee: K Boysen
Date: 11-10-03

COLUMN OF WATER IN WELL

Well Casing Diameter (inches): 2
Filter Pack Diameter (if known [inches]) 4
Sounding Depth of Well (from top of casing [feet]) 10.17
Static Water Depth (from top of casing [feet]) 7.95
Column of water in well (feet) 2.22
Time Waterlevels Measured: 0855

VOLUME TO BE PURGED

(3 **well casing** volumes only, unless otherwise specified)

Gallons per foot of filter pack (on reverse)	=	0.13
Column of water in filter pack	x	2.22
Volume of water column in filter pack	=	.29
Gallons per foot of casing (on reverse)	=	~~0.163~~
Column of water in well	x	~~2.22~~
Volume of water in casing	=	.36
Total water volume (filter pack + casing)	x	.65
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	1.95

Purging Method: Peristaltic Pump

FIELD PARAMETERS

Time	Volume purged (gallons)	pH	Conductivity (µS)	TDS (ppm)	Temperature (F or C)	Turbidity	Color	Odor	ORP (mV Units)
0907	.50	6.9		030	46		Dk beige	None	
0917	1.00	6.8		000	46		Clear	None	
0921	1.10	6.8		000	46		Clear	None	

Total volume purged: 1.2 gallons
Withdrawal Rate:
Sample Identification:
Sample Time/Date: 0936 11-11-03
Duplicate Collected? yes no
Duplicate Identification:
Signed Sampler: Date:
Signed Reviewer: Date:

ADDITIONAL INFORMATION/COMMENTS: No noticable hydrocarbon-like sheen or odor. Well Purged Dry at 1.10 Gallons.

BTEX

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Well Sampling Calculation and Record Sheet

Client: ADEC
Well Number: MW-9 (MAPLE TREE)
Site Name: WRANGELL INSTITUTE
SLR Project # :
SLR Employee: KLIEFORTH
Date: 11/11/03

COLUMN OF WATER IN WELL

Well Casing Diameter (inches): 2"
Filter Pack Diameter (if known [inches]) 4" (PREPACK)
Sounding Depth of Well (from top of casing [feet]) 9.45
Static Water Depth (from top of casing [feet]) 4.02
Column of water in well (feet) 5.43
Time Waterlevels Measured: 0825

VOLUME TO BE PURGED

(3 **well casing** volumes only, unless otherwise specified)

Gallons per foot of filter pack (on reverse)	=	0.13
Column of water in filter pack	x	5.43
Volume of water column in filter pack	=	0.7059
Gallons per foot of casing (on reverse)	=	0.163
Column of water in well	x	5.43
Volume of water in casing	=	0.88509
Total water volume (filter pack + casing)	x	1.59
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	4.68

Purging Method: BAILER

FIELD PARAMETERS

Time	Volume purged (gallons)	pH	~~TDS~~ Conductivity (µS)	TDS (ppm)	Temperature (F or C)	Turbidity	Color	Odor	ORP (mV Units)
0854	0.5	6.7	70		46		PALE RUSTY	RED BROWN	
	1.0	6.2	70		45		"		
0854	2.0	6.1	60		45		"		
0902	3.0	6.0	60		46		BAILER		
0905	4.0	6.0	60		46		BAILER		
0912	4.8	6.0	60		46		BASICALLY	CLEAR	

Total volume purged: 4.8 gallons
Withdrawal Rate:
Sample Identification: MW-9
Sample Time/Date: 11/11/03 0915
Duplicate Collected? yes (no)
Duplicate Identification:
Signed Sampler: [signature]
Date: 11/11/03
Signed Reviewer:
Date:

ADDITIONAL INFORMATION/COMMENTS: NO ODOR. NO ~~SHEEN~~ NO SHEEN.

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Well Sampling Calculation and Record Sheet

Client: ADEC
Site Name: Wrangell Institute
SLR Employee: K Boltesen

Well Number: MW-10
SLR Project # : 005.0065.03003
Date: 11-11-03

COLUMN OF WATER IN WELL

Well Casing Diameter (inches):	2	Filter Pack Diameter (if known [inches])	4
Sounding Depth of Well (from top of casing [feet])	11.16		
Static Water Depth (from top of casing [feet])	6.60		
Column of water in well (feet)	4.56		
Time Waterlevels Measured:	10.15		

VOLUME TO BE PURGED

(3 **well casing** volumes only, unless otherwise specified)

Gallons per foot of filter pack (on reverse)	=	0.13
Column of water in filter pack	x	4.56
Volume of water column in filter pack	=	.59
Gallons per foot of casing (on reverse)	=	0.163
Column of water in well	x	4.56
Volume of water in casing	=	.74
Total water volume (filter pack + casing)	x	1.33
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	3.99

Purging Method: Peristaltic Pump

FIELD PARAMETERS

Time	Volume purged (gallons)	pH	Conductivity (µS)	TDS (ppm) MG	Temperature (F or C)	Turbidity	Color	Odor	ORP (mV Units)
1028	0.50	6.1		~~080~~ 080	49		Rust	None	
1033	1.50	6.1		080	50		Mud brn.	None	
1039	2.50	6.2		170	50		Mud brown	None	
1048	3.50	6.2		150	48		"	"	
1051	3.90	6.2		140	49		"	"	
1055	4.25	6.2		140	49		"	"	

Total volume purged: 4.50 gallons
Withdrawal Rate:
Sample Identification: MW-10
Sample Time/Date: 1055 11-11-03
Duplicate Collected? yes (no)
Duplicate Identification:
Signed Sampler: Date:
Signed Reviewer: Date:

ADDITIONAL INFORMATION/COMMENTS: No noticeable hydrocarbon-like odor or sheen. Good recharge. Well is bailed, ~~bailed~~ dry.